

# The malkarid spiders of New Zealand (Araneae: Malkaridae)

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**Abstract.** This paper addresses the systematics of the New Zealand spiders of the family Malkaridae. Malkarids are small araneoid spiders that live primarily in the leaf litter and mosses of temperate and tropical wet forests in Australia and New Zealand, with the exception of a single species in southern South America and another in New Caledonia. We treat the New Zealand species of Malkaridae that are not members of the subfamily Pararchaeinae, a monophyletic group of 11 new species that we classify in 2 new genera (*Tingotingo*, gen. nov. and *Whakamoke*, gen. nov.) and a new subfamily (Tingotinginae, subfam. nov.). We describe, diagnose, illustrate and map the distribution of specimen records of these 11 new species of New Zealand Malkaridae: *Tingotingo porotiti*, sp. nov., *T. pouaru*, sp. nov., *T. tokorera*, sp. nov., *T. aho*, sp. nov., *Whakamoke orongorong*, sp. nov.; *W. tarakina*, sp. nov.; *W. guacamole*, sp. nov.; *W. hunahuna*, sp. nov.; *W. paoka*, sp. nov.; *W. heru*, sp. nov.; and *W. rakiura*, sp. nov. We also treat the phylogenetic relationships of Malkaridae and use the results of our previous work on the molecular phylogeny of Araneoidea as the bases for the classification of the family. *Tingotingo*, gen. nov. and *Whakamoke*, gen. nov. are sister clades. Tingotinginae, subfam. nov. is the sister group of the Malkarinae plus Pararchaeinae clade. We further hypothesise and discuss the morphological synapomorphies of Malkaridae, Tingotinginae, subfam. nov. and the two new genera.

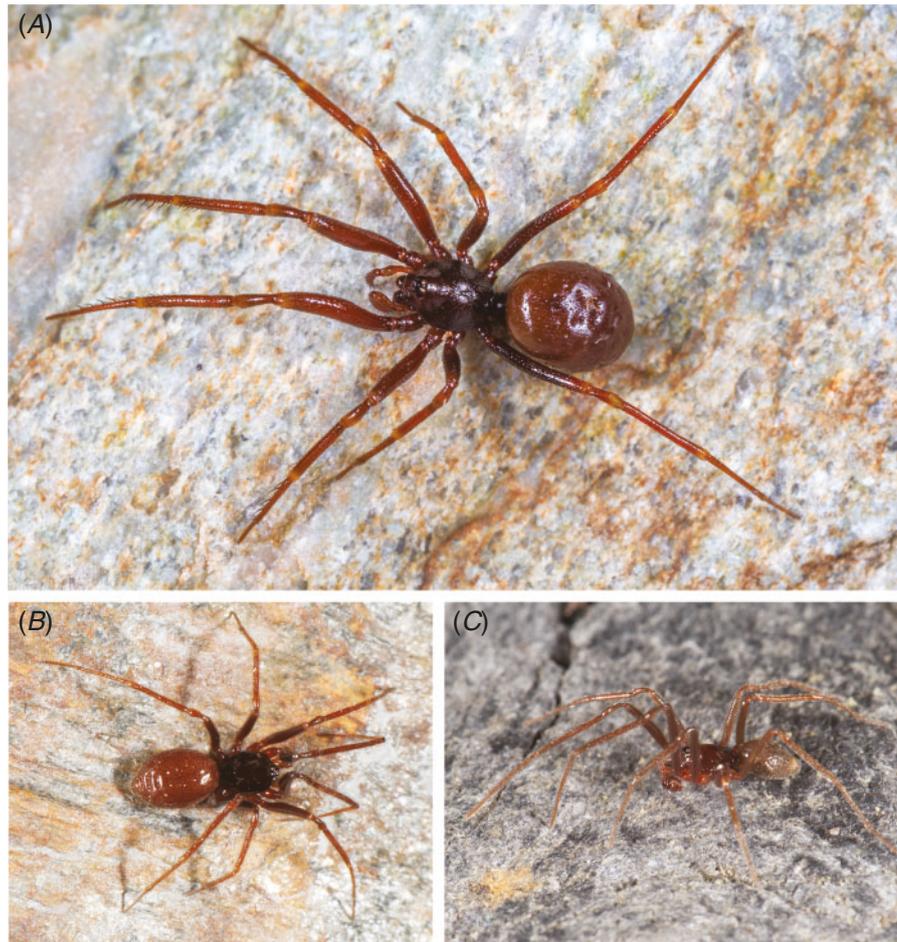
**Additional keywords:** arachnids, Araneoidea, cryptic fauna, diversity, leaf-litter.

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## Introduction

Malkarids are small araneoid spiders that live primarily in the leaf litter and mosses of temperate and tropical wet forests in Australia and New Zealand, with the exception of a single species in southern South America and another in New Caledonia (Fig. 1–3). The natural history of malkarids is largely a mystery (with the exception of egg sac structures in pararchaeine malkarids: see Rix 2006; Rix and Harvey 2010), and very little is known about their cryptic habits beyond what can be read from the collecting labels of museum specimens, which are themselves not particularly abundant in collections. Most malkarid specimens in museums have been collected with pitfall traps, some have been sifted from leaf litter and mosses or extracted with Berlese or Winkler funnels, and a few have been found under fallen logs, but very few people, and certainly not ourselves, can claim to have observed a live malkarid wandering around in the wild (other than on a sifting tray or the fabric of a sifter). Malkarids are presumed to be cursorial (Forster and Forster 1999, p. 113) and none have been collected in a capture web, a conjecture that is supported by the extremely reduced set of silk gland spigots (Schütt 2000; Rix and Harvey 2010) (Fig. 8, 11). Due to these facts,

and the presence of a row of strong prolateral spines on the front legs, it has been suggested that malkarids are araneophageous (Forster and Forster 1999; Wunderlich 2004). The only known photograph of a live malkarid feeding on a spider (Fig. 2A; Bryce McQuillan, pers. obs.) seems to support this hypothesis. Most non-pararchaeine malkarids appear to be rare in nature, and extracting these spiders from leaf litter, even when the conditions are right (locality, season, moisture, etc.) requires firm resolve and considerable time. Nothing better illustrates the rarity of malkarids than the fact that the late Ray R. Forster (1922–2000), New Zealand’s most eminent arachnologist (Patrick *et al.* 2000), after a lifetime of collecting in New Zealand and with a revision of non-pararchaeine malkarids in progress before his death, had only assembled a fairly modest number of vials (which included specimens from several museums as well). Our own fieldwork in New Zealand, despite targeting this group, has produced a very modest increase in the number of specimens available for study. As currently classified, the family Malkaridae includes 11 genera and 46 described species (ver. 20.0, World Spider Catalog, Natural History Museum, Bern, Switzerland, see <http://wsc.nmbe.ch>, accessed 20 December 2019). In this paper, we



**Fig. 1.** New Zealand malkarids. *A*, *Whakamoke rakiura*, sp. nov., female from Stewart Island (G. Hormiga, photo). *B*, *Whakamoke heru*, sp. nov., male from Flora Saddle, Kahurangi National Park, South Island (G. Hormiga, photo). *C*, *Whakamoke heru*, sp. nov., female from the same locality (N. Scharff, photo).

describe the Malkaridae of New Zealand that are not members of the subfamily Pararchaeinae, a monophyletic group endemic to New Zealand that includes 2 undescribed genera and 11 new species, which are now grouped under a newly erected subfamily (Tingotinginae, subfam. nov.). The pararchaeines have been recently revised by Rix (2005, 2006), at that time under the family name Pararchaeidae Forster & Platnick, 1984. More recently the family Malkaridae Davies, 1980 was recircumscribed by Dimitrov *et al.* (2017) to include Pararchaeidae, that was rendered a junior synonym. Given the recent revisions of pararchaeines of Rix (2005, 2006; see also Rix and Harvey 2010) we do not redescribe those species in our paper, but the New Zealand taxa are listed in our taxonomic treatment.

### Taxonomic history of malkarids

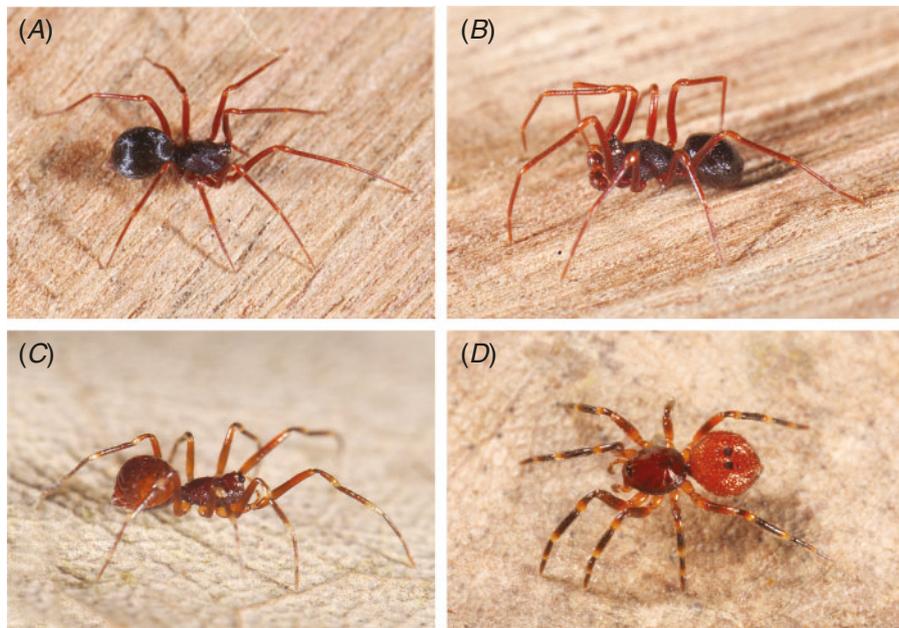
The first genus and species of malkarid was described by Butler (1929) as *Sternodes foraminatus*, based on a male specimen from Victoria (Australia), and was placed in the family Palpimanidae. Three years later, Butler (1932) would describe another malkarid genus and species, *Perissopmeros*

*castaneus* Butler, 1932, this time from New South Wales, based also on a single male specimen which he classified in the family Zodariidae. Forster (1949) described *Pararchaea rubra*, initially placed in the genus *Zearchaea* Wilton, 1946, and included it in the family Archaeidae (subsequently Rix (2006) would transfer this species to the genus *Forstrarchaea* Rix, 2006). Forster erected *Pararchaea* Forster, 1955 to group several species from New Zealand and Australia, although later most of those species would be transferred to other genera (see Rix 2006) and *Pararchaea* is currently monotypic.

Davies (1980) described the genus *Malkara* Davies, 1980, based on male and female specimens from southern Queensland and suggested affinities with the family Araneidae Clerk, 1757, erecting the subfamily Malkarinae to accommodate this species. Shortly thereafter, Forster and Platnick (1984) erected the family Pararchaeidae for *Pararchaea*, and placed it in their expanded circumscription of the superfamily Palpimanoidea. Pararchaeids were diagnosed by having chelicerae originating from a completely sclerotised foramen in the carapace, by their entelegyne genitalia (females have fertilisation ducts, unlike archaoids and mecysmaucheniids) and the presence of a 'paracymbial process' on the male palp (Forster and Platnick



**Fig. 2.** New Zealand malkarids. *A*, *Whakamoke* sp. from Ruahine Forest, North Island, feeding on another spider (Bryce McQuillan, photo). *B*, same female as in *A*. *C*, *Whakamoke paoka*, sp. nov., male from Banks Peninsula, South Island (N. Scharff, photo). *D*, *Tingotingo tokorera*, sp. nov., female from Lake Waikaremoana, North Island (N. Scharff, photo).



**Fig. 3.** Australian malkarids. *A*, *Perissopmeros* sp., female from Macquarie Pass, New South Wales (G. Hormiga, photo). *B*, *Perissopmeros* sp., male from the same locality (G. Hormiga, photo). *C*, *Malkara* sp., female from Tully Falls, Queensland (G. Hormiga, photo). *D*, *Malkara* nr *loricata*, female from Mount Glorious, Queensland (Greg Anderson, photo).

1984, p. 65). Wunderlich (1986, p. 124) elevated Malkarinae to family rank, suggesting them as the sister group of Mimetidae based on the leg spination pattern and the absence of capture webs. Moran (1986) erected the spider family Sternodidae (subsequently replaced by Sternoidinae; see Harvey (2002)

and Rix *et al.* (2009)) for two genera, the eastern Australian genus *Sternodes* Butler, 1927 and a new Tasmanian genus, *Carathea* Moran, 1986. Moran defined Sternodidae by the presence of a pair of sulci in the carapace margin, between the palp and leg I, and by the presence of a greatly enlarged basal

flange on the male palpal conductor supporting the embolus for most of its length. Moran (1986) synonymised *Perissopmeros* under *Sternodes*, redescribed the type species (*Sternodes foraminatus* Butler, 1927) and described six new species, including four *Sternodes* (*S. mullawerringi* Moran, 1986, *S. arkana* Moran, 1986, *S. grayi* Moran, 1986, *S. quinguni* Moran, 1986), and two *Carathea* (*C. parawea* Moran, 1986 and *C. miyali* Moran, 1986). Platnick and Forster (1987) described the only malkarid known from South America in the monotypic genus *Chilenodes* Platnick & Forster, 1987, which they considered closely related to *Sternodes* and *Carathea*, and suggested affinities of this latter lineage to the genus *Malkara*. Platnick and Forster (1987) grouped the species in *Sternodes*, *Carathea* and *Chilenodes* under the family Malkaridae. Although Moran (1986, p. 91) deemed *Perissopmeros* a junior synonym of *Sternodes* Butler, 1929, this latter genus name is preoccupied in Coleoptera and in Hymenoptera and therefore *Perissopmeros* has priority over the superfluous replacement name *Sternoides* Platnick, 1998.

#### *Monophyly and familial placement*

Opinions on the affinities of malkarids have been diverse from the very beginning. Butler (1929) placed *Sternodes* in Palpimanidae. Three years later Butler (1932) described *Perissopmeros* and placed it in Zodariidae (both species described by Butler are members of *Perissopmeros*). Davies (1980) described *Malkara* and placed it in the orb-weaving family Araneidae after carefully assessing other possible araneoid relatives (Mimetidae, Cyatholipidae, Nesticidae, Linyphiidae and Theridiidae). Moran (1986) erected the family Sternodidae for *Sternodes* and the new genus *Carathea* but did not suggest a clear hypothesis of relationships. As mentioned above, Forster and Platnick (1984) hypothesised placement of pararchaeines in Palpimanoidea, whereas Wunderlich (1986) explicitly suggested a sistergroup relationship of (non-pararchaeine) malkarids to Mimetidae. Eskov (1987) considered Pararchaeidae as a group within Archaeidae, ranking them as a subfamily.

In a study on the limits of the superfamily Araneoidea, Schütt (2000) suggested that malkarids and pararchaeids (but also mimetids and holarchaeids) were araneoids, rather than palpimanoids, and the morphological analysis of entelegyne relationships of Griswold *et al.* (2005) concurred with her results. Agnarsson (2004, p. 466) had suggested the possibility of close phylogenetic propinquity between some hadrotarsine theridiids and *Chilenodes* based on the presence of stridulatory striae in the anterior lateral spinneret of the latter genus and in some hadrotarsines, but our current understanding of araneoid relationships (see Fernández *et al.* 2018a, 2018b; Kulkarni *et al.* 2020) demonstrates that such similarity must have evolved convergently. In fact, the alleged similarities between *Sternodes foraminatus* and the theridiid genus *Phoroncidia* pointed out by Agnarsson (2004, pp. 466, 577), namely the ‘spines’ on the tegulum, are based on an erroneous interpretation of such structures. What Agnarsson refers to as ‘spines on tegulum’ in *Sternodes foraminatus* (see *S. mullawerringi* Moran, 1986, fig. 9, 11; Moran’s publication did not have SEM micrographs of *S. foraminatus*) are papillae on

the membranous base of the conductor, and thus not homologous to the projections of *Phoroncidia*, which are found on the tegulum.

In a paper on the relationships and classification of mimetids, which he considered to be araneoids and not palpimanoids, Wunderlich (2004) delimited Mimetidae *sensu lato* to include three subfamilies: Mimetinae (Mimetini plus Oarcini), Malkarinae (Malkarini plus Sternodini), and Pararchaeinae (Pararchaeini plus Holarchaeini). Support for his hypothesis of Mimetidae membership came from ‘the capture legs I and II with mimetid bristles in both sexes, large chelicerae, long embolus, mainly araneophagous feeding behaviour, loss of capture web, triade [*sic*] and sustentaculum’ (p. 1254). Wunderlich (2004, p. 1254) suggested that the presence of cheliceral peg teeth provided support for a sister group relationship between Pararchaeinae and Mimetinae (with the peg teeth being secondarily absent in *Holarchaea*). Subsequent studies have shown that oarcines are a lineage of Araneidae and that *Holarchaea* is nested within Anapidae (Dimitrov *et al.* 2017). The molecular analyses of Rix *et al.* (2008) and Dimitrov *et al.* (2012) supported placement in Araneoidea of Malkaridae, Mimetidae, and Pararchaeidae, but the interrelationships of the araneoid families were poorly resolved. The placement of Pararchaeidae within Araneoidea was further corroborated by Wood *et al.* (2012) based on both molecular and morphological data. The first empirical support of the propinquity of pararchaeids and malkarids was provided by the molecular analyses of Dimitrov *et al.* (2017). That study found strong support for the monophyly of a group that included 27 pararchaeid and malkarid terminals of their analysis, with some optimal topologies implying paraphyly of the latter family. Based on these findings Pararchaeidae was synonymised with Malkaridae (Dimitrov *et al.* 2017). In that study, some of the analyses supported a sister-group relationship between Pararchaeidae and Malkaridae, and if both Malkaridae and Pararchaeidae turned out to be reciprocally monophyletic they could be ranked as subfamilies while retaining the new family diagnosis provided. Dimitrov *et al.* (2017) listed as putative morphological synapomorphies of the recircumscribed Malkaridae the abdomen with a ventral abdominal scutum that surrounds the pedicel (at least in males), the sclerotised ring around spinnerets, abdominal setae arising from sclerotised discs, the abdomen with sigilla, the sternum fused around the petiole to the carapace, a conductor encircling the embolus in a counter-clockwise direction and with a conspicuous basal apophysis and the absence of the posterior lateral spinneret araneoid triad.

Most recently, the transcriptomic phylogenetic analyses of Fernández *et al.* (2018a, 2018b) corroborated the monophyly of Malkaridae as delimited by Dimitrov *et al.* (2017), based on data for *Pararchaea alba* Forster, 1955, an undescribed *Malkara* species from Queensland, *Perissopmeros* sp. and *Whakamoke paoka*, spec. nov. (the latter was labelled as ‘Malkaridae sp. 9’).

Regarding the placement of Malkaridae in the phylogeny of araneoids, most recent studies strongly support a clade composed of the families Malkaridae, Mimetidae, Arkyidae and Tetragnathidae. The monophyly of such a group has been

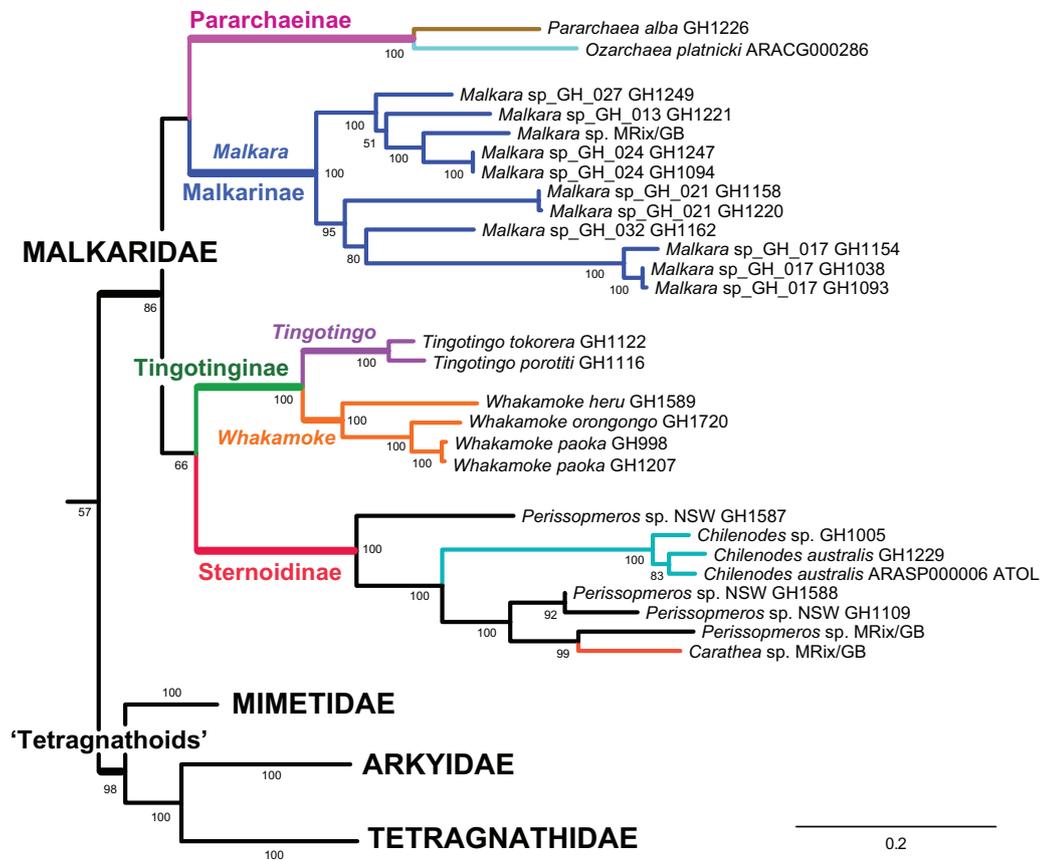
hypothesised with Sanger sequencing using the six standard markers (the so-called ‘usual suspects’: Dimitrov *et al.* 2017; Wheeler *et al.* 2017), Sanger sequencing data combined with morphological characters (Benavides and Hormiga 2020), transcriptomes (Fernández *et al.* 2018a, 2018b) and ultraconserved elements (Kulkarni *et al.* 2020). All of these studies (except Benavides *et al.* 2020) agree in having Malkaridae sister to a [Mimetidae (Arkyidae, Tetragnathidae)] clade; this latter lineage (the sister group of malkarids) has been informally named ‘tetragnathoids’ (Hormiga 2017). In sum, nucleotide sequencing data suggest that the tetragnathoids are the sister group of Malkaridae.

## Methods

Specimens were examined and illustrated using a Leica M205A stereoscopic microscope equipped with a Leica DFC425 camera and LAS software or with a camera lucida (Leica Microsystems, Wetzlar, Germany). Further details were studied and illustrated using a Leica DMRM or an Olympus BX40 compound microscope with a camera lucida (Olympus Corporation of the Americas, Center Valley, PA, USA). Single stereoscope images were stacked with Helicon

Focus software (ver. 6.7.1, Helicon Soft Ltd, see www.heliconsoft.com) to increase depth of field. Left structures (i.e. palps or legs) are depicted unless otherwise stated. Most setae and macrosetae are not depicted in the final palp and epigynum drawings. Drawings were rendered using a graphite mechanical pencil, then scanned and edited using Adobe Photoshop. Plates were assembled using Adobe Illustrator (Adobe, San Jose, CA, USA). Morphological measurements were taken using the LAS Live Measurement module in the dissecting microscope. All morphological measurements are expressed in millimetres. Female genitalia were excised using surgical blades or sharpened needles. Epigyna were transferred to methyl salicylate (Holm 1979) for examination under the microscope. Scanning electron microscopy (SEM) images were captured using the LEO 1430VP (Zeiss, Oberkochen, Germany) at the Department of Biological Sciences of The George Washington University. Specimens were critical-point dried, sputter-coated in a gold–palladium alloy, and mounted as described in Álvarez-Padilla and Hormiga (2007).

Label data from museum specimens are reported verbatim in the ‘Specimens examined’ section of the species descriptions. Longitude and latitude data inferred from



**Fig. 4.** Phylogenetic relationships of Malkaridae based on the molecular phylogeny of Dimitrov *et al.* (2017, fig. 2 and S3), using sequences from six standard genes or gene fragments. The depicted topology results from the maximum-likelihood analysis of the full dataset; the informal temporary names of malkarids used in Dimitrov *et al.* (2017) have been replaced with the updated nomenclature of this revision. Nodal support is expressed as maximum-likelihood bootstrap values. The outgroups in the ‘Tetragnathoid’ families have been collapsed in the figure and are represented in the original cladogram by the following number of terminals: 6 (Mimetidae, 4 genera), 9 (Arkyidae, 2 genera) and 44 (Tetragnathidae, 27 genera) (see Dimitrov *et al.* (2017) for details).

museum labels without coordinates are denoted by ‘(\*)’, otherwise they are reported as written on the label. In the taxonomic section of the new genera, the species are described in the order given under the ‘Composition’ section of each genus, starting with the type species.

The phylogenetic relationships of Malkaridae (Fig. 4) follow the recent molecular phylogeny of Araneoidea (Dimitrov *et al.* 2017, fig. 2, S3) and are based on nucleotide sequences from six genes or gene fragments: two nuclear ribosomal genes, *18S* rRNA (~1800 bp) and *28S* rRNA (~2700 bp); two mitochondrial ribosomal genes, *12S* rRNA (~400 bp) and *16S* rRNA (~550 bp); the nuclear protein-encoding gene histone H3 (327 bp); and the mitochondrial protein-encoding gene cytochrome c oxidase subunit I (771 bp). We have used the topology from the maximum-likelihood analyses of the full dataset (Dimitrov *et al.* 2017, fig. S3) and replaced the informal temporary names of malkarids with the updated nomenclature of this study.

Museum depositories of the specimens studied in this work are abbreviated as follows: AMNH, American Museum of Natural History (New York, USA); AWMM, Auckland War Memorial Museum (Auckland, New Zealand); CMNZ, Canterbury Museum (Christchurch, New Zealand); CAS, California Academy of Sciences (San Francisco, USA); FMNH, Field Museum of Natural History (Chicago, USA); MCZ, Museum of Comparative Zoology, Harvard University (Cambridge, USA); MNZ, Museum of New Zealand Te Papa Tongarewa (Wellington, New Zealand); NZAC, New Zealand Arthropod Collection, Manaaki Whenua Landcare Research (Auckland, New Zealand); OM, Otago Museum (Dunedin, New Zealand); QM, Queensland Museum (Brisbane, Australia); and ZMUC, Zoological Museum, Natural History Museum of Denmark, University of Copenhagen (Copenhagen, Denmark).

#### *Anatomical abbreviations used in text and figures*

AC, aciniform gland spigot; ALS, anterior lateral spinneret; BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; CD, copulatory duct; CY, cylindrical gland spigot; E, embolus; EB, embolus base; FD, fertilisation duct; mAP, minor ampullate spigot; MAP, major ampullate spigot; P, paracymbium; PI, piriform spigot; PMS, posterior median spinneret; PLS, posterior lateral spinneret; S, spermatheca; ST, subtegulum; T, tegulum.

## Taxonomy

### Order Araneae Clerk, 1757

Superfamily Araneoidea Clerk, 1757

Family Malkaridae Davies, 1980

Malkarinae Davies, 1980: 377.

*Type genus: Malkara* Davies, 1980, described under Araneidae.

Malkaridae Wunderlich, 1986: 124. – Platnick and Forster 1987: 1. Forster and Forster 1999: 113. Paquin *et al.* 2010: 40. Dimitrov *et al.* 2017: 243. Wheeler *et al.* 2017: 596.

Sternoidinae Moran, 1986: 88.

*Type genus: Sternodes* Butler, 1929. Considered a subfamily of Malkaridae by Platnick and Forster (1987, p. 9).

Sternoidinae Harvey, 2002: 456. Replacement name for Sternoidinae Moran, 1986.

Sternoidini Wunderlich, 2004: 1259. Synonymised with Sternoidinae Harvey, 2002 by Rix *et al.* (2009, p. 300).

Pararchaeidae Forster and Platnick, 1984: 65. – Rix 2005: 136. Rix 2006: 204. Paquin *et al.* 2010: 44. Rix and Harvey 2010: 28.

*Type genus: Pararchaea* Forster, 1955. Considered a subfamily of Malkaridae by Dimitrov *et al.* (2017, p. 243).

#### *Diagnosis*

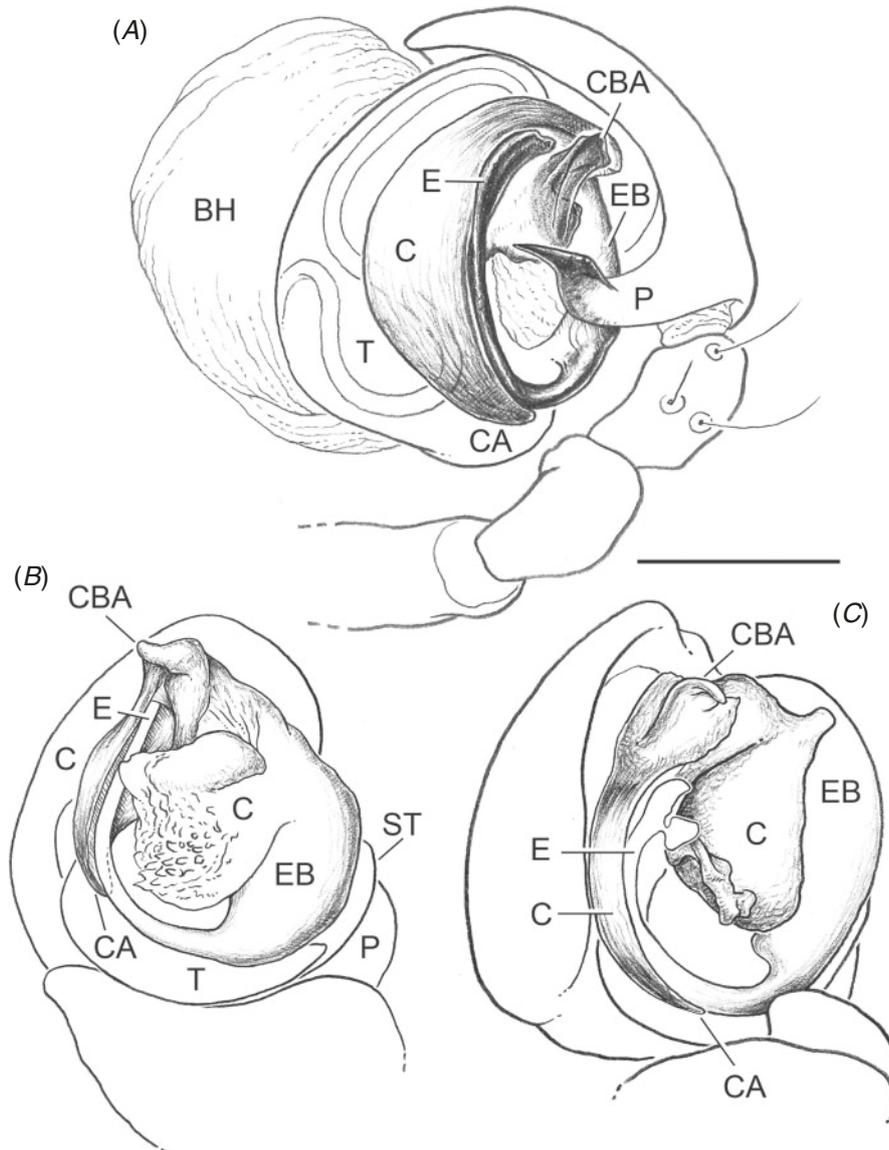
Small to very small araneoid spiders (Fig. 1–3). Male palp with basal integral paracymbium (Fig. 5A, 6A, 7D, 10H, 16D) and no median apophysis. Unlike most other araneoids, in most malkarids the conductor circles the embolus in the opposite direction (counter clockwise, left palp ventral view: Fig. 5A–C, 10B) although conductor morphology is highly variable and in some species of pararchaeines this sheath is very small. Body armoured with a ventral abdominal scutum around the pedicel in males (sometimes also in females) and a sclerotised ring around the spinnerets in both sexes (Fig. 18; the males of some species have a dorsal abdominal scutum). Abdomen with sclerotised sigilla (Fig. 18, 32). Like mimetids, both sexes lack aggregate and flagelliform gland spigots on posterior lateral spinnerets (Fig. 8, 11). Some malkarids, particularly some of the New Zealand species in Tingotinginae, subfam. nov., have leg I and II spination very similar to that of mimetids (arranged in a row with alternating long and short spines: Fig. 14). Malkarids can be distinguished from the mimetids by the unique conformation of the palpal conductor (Fig. 5–7, 10, 16) and the absence of cheliceral peg teeth (except pararchaeines, which have peg teeth).

#### *Composition*

A total of 13 genera and 57 species of malkarids have been described so far, including the 2 new genera and 11 new species presented in this paper. Numerous new malkarid species remain to be described from Australia (G. Hormiga and N. Scharff, unpubl. data). The family Malkaridae includes the genera *Anarchaea* Rix, 2006; *Carathea* Moran, 1986; *Chilenodes* Platnick & Forster, 1987; *Flavarchaea* Rix, 2006; *Forstrarchaea* Rix, 2006; *Malkara* Davies, 1980; *Nanarchaea* Rix, 2006; *Ozarchaea* Rix, 2006; *Pararchaea* Forster, 1955; *Perissopmeros* Butler, 1933; *Tingotingo*, gen. nov.; *Westrarchaea* Rix, 2006; and *Whakamoke*, gen. nov.

#### *Phylogenetics*

Putative morphological synapomorphies of Malkaridae (see also Dimitrov *et al.* 2017) include the abdomen with ventral abdominal scutum that surrounds the pedicel (at least in males) (Fig. 9E, 18B, E), sclerotised ring around spinnerets (Fig. 18B), abdominal setae arising from sclerotised discs (Fig. 18A), abdomen with sigilla (Fig. 18A), sternum fused around petiole to carapace, conductor encircling the embolus in a counter-clockwise direction and with a conspicuous basal apophysis (Fig. 5–7, 10, 16, 17), and



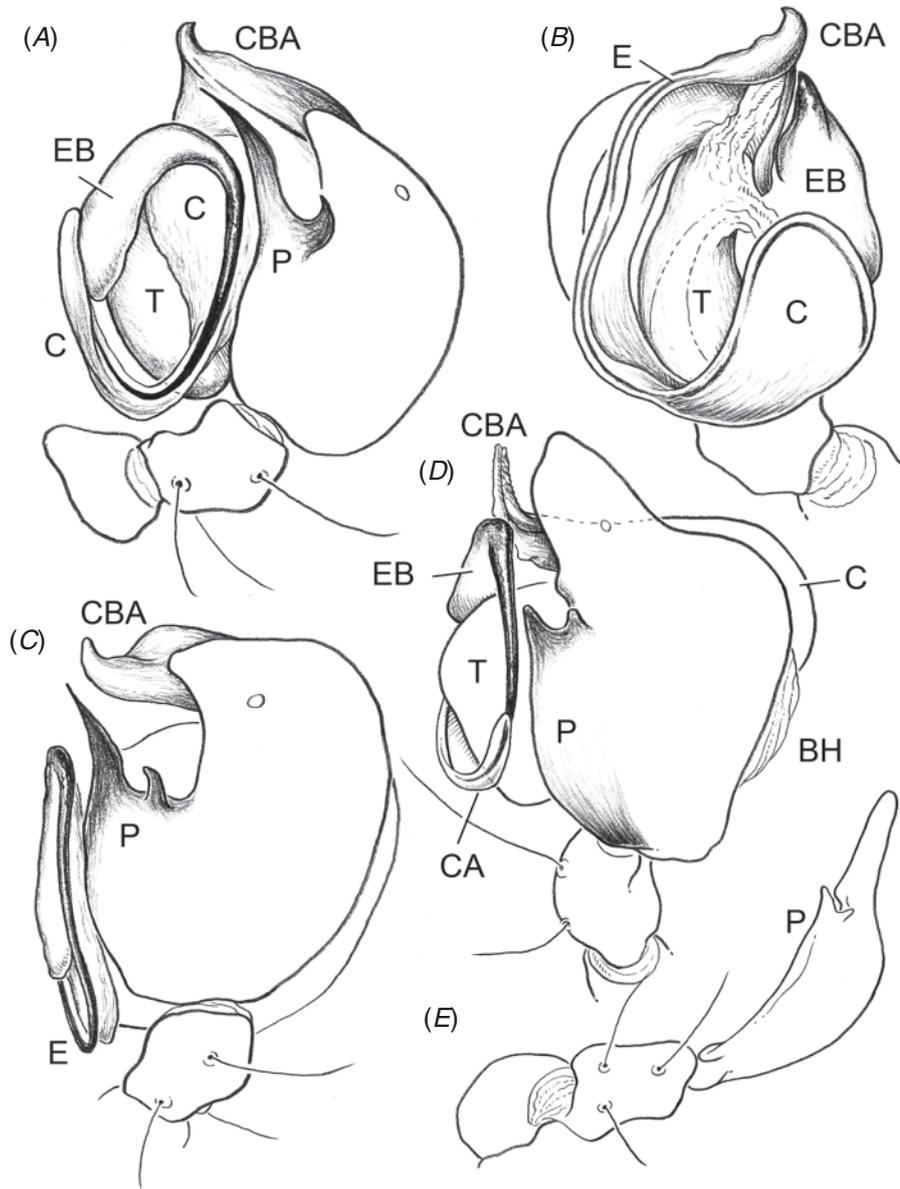
**Fig. 5.** Male palpal morphology of Malkaridae. *A*, *Malkara loricata* Davies, 1980, expanded. *B*, *Anarchaea robusta* (Rix, 2005), ectoventral (traced from SEM: Rix 2005, fig. 24). *C*, *Flavarchaea lofty* Rix, 2006, mesoventral (traced from SEM, right palp reversed: Rix 2005, fig. 38). Scale bar, 0.2 mm. Abbreviations: BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

absence of the PLS araneoid triad (Rix and Harvey 2010) (Fig. 8, 11, 16, 17). Dimitrov *et al.* (2017) and Fernández *et al.* (2018a, 2018b) provided molecular evidence for the monophyly of Malkaridae. The hypothesis on the phylogenetic relationships of malkarids used here to classify the family follows the results of the previous molecular analysis (Dimitrov *et al.* 2017, fig. 2, S3), which used 27 malkarid terminals in eight genera (Fig. 4). On the basis of that phylogenetic hypothesis we have classified Malkaridae into four subfamilies: Malkarinae Davies, 1980, Sternoidinae Harvey, 2002, Pararchaeinae Forster & Platnick, 1984, and Tingotinginae, subfam. nov. The placement of *Chilenodes*

*australis* and of *Carathea* in a clade that otherwise includes all the *Perissopmeros* terminals in the analysis (subfamily Sternoidinae: Fig. 4) indicates that *Perissopmeros* is not monophyletic as currently circumscribed. We will address this latter taxonomic problem in a forthcoming revision of the Australian Malkaridae.

#### Distribution

Australia (Malkarinae, Pararchaeinae, Sternoidinae), New Zealand (Pararchaeinae, Tingotinginae), New Caledonia (Pararchaeinae) and Chile (Sternoidinae).

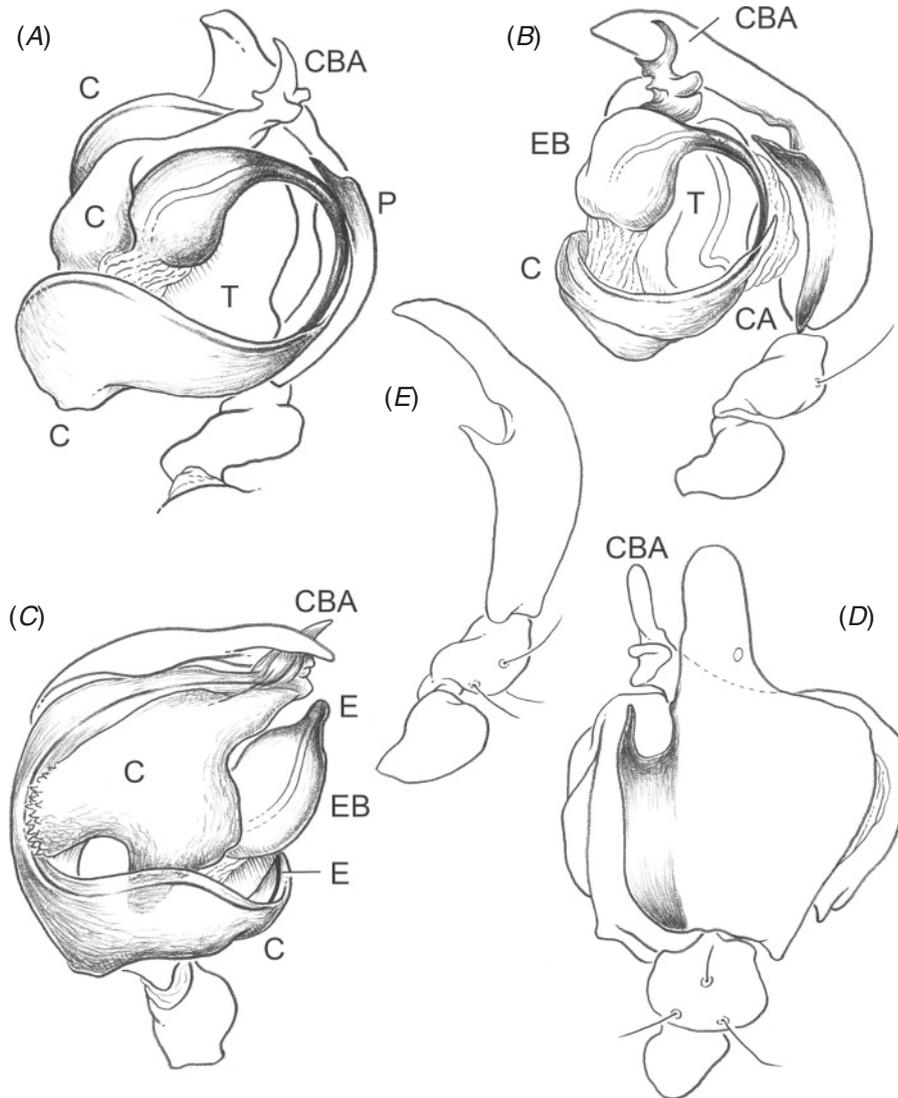


**Fig. 6.** Male palpal morphology of Malkaridae (schematic). *A–C*, *Chilenodes australis* Platnick & Forster, 1987. *D, E*, *Caratheia parawea* Moran, 1986. *A*, Ectoventral. *B*, Ventral. *C*, Dorsal. *D*, Dorsoectal, partially expanded. *E*, Ectal. Abbreviations: BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

#### *Male palpal morphology of Malkaridae*

The recently proposed close phylogenetic affinities of malkarids and pararchaeids, along with the description of the New Zealand taxa treated in this study and a preliminary assessment of the species diversity in the Australian genus *Malkara*, calls for an evaluation of male palpal morphology in the family. Despite considerable variation in their somatic morphology, malkarids share several male genitalic features that make their palps readily identifiable as members of this clade (Fig. 5–7, 10, 16, 17, 20, 34). The pedipalpal patella and tibia of malkarids is

unmodified, lacking apophyses or processes found in some araneoid groups (e.g. the tibial apophyses of erigonine linyphiids). The cymbium is generally cup-shaped, always with a basally placed integral paracymbium (i.e. lacking a membranous connection to the cymbium (Fig. 5–7, 10A–C, H)), which in some cases has a variety of distal apophyses and processes, particularly in the Pararchaeinae. In some *Malkara* species, the paracymbium extends anteriorly almost the entire length of the cymbium, whereas in others the paracymbium extends in a caudal direction and is longer than the cymbium itself. In ventral view, the most prominent feature is the base of

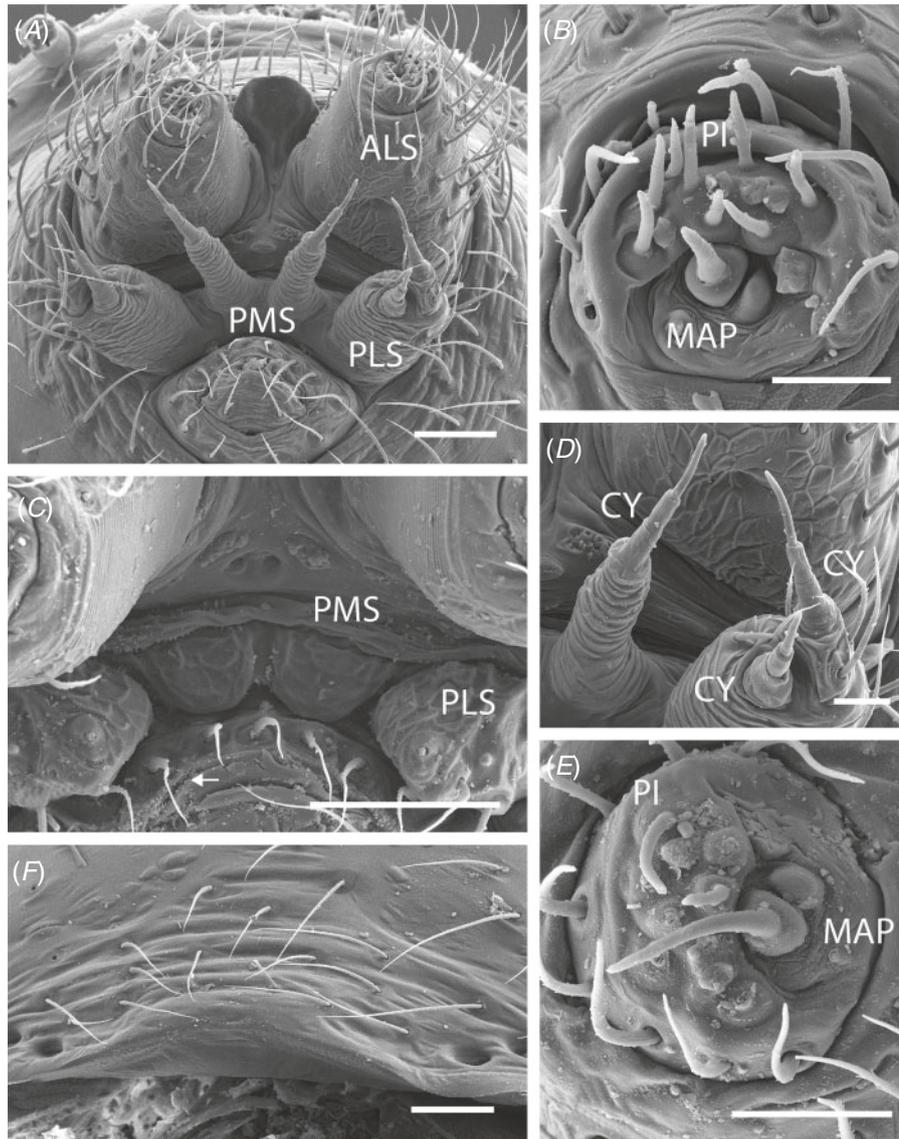


**Fig. 7.** Male palpal morphology of *Perissopmeros* nr *qinguni* (schematic). *A*, Ectoventral. *B*, Ectal. *C*, Ventral. *D*, Dorsal. *E*, Ectal. Abbreviations: BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

the conductor (termed by Rix (2005, 2006) the ‘distal plate’), which is distally placed on the tegulum (Fig. 5–7, 10). The conductor has a more or less membranous sheath or flange that extends circling along the outer margin of the tegulum in the opposite direction to the embolus, often ending near the base of the embolus (Fig. 5, 10, 20). This distal plate, with its sheath extension, is a homologue of the araneoid conductor and is also present in the closest relatives of malkarids (Mimetidae, Arkyidae and Tetragnathidae; see Álvarez-Padilla and Hormiga 2011; Benavides and Hormiga 2020). We have termed this most apically placed part of the conductor the conductor base and it often has apophyses of varying degrees of sclerotisation (CBA, conductor basal apophysis), which seem to be of species-specific morphology. The

conductor base is connected to the tegulum through a membrane (and thus its name, despite its apical position in the palp) and it often bears papillae (Fig. 16*A, C*, 17*D*), usually in its caudal region; Rix (2005, 2006) referred to it as the ‘sculpturing’ of the distal plate. In malkarids, the embolus connects to the tegulum through a membrane, adjacent to the membranous connection of the conductor (at least in some species of *Malkara* the embolus and the conductor share the membrane connecting to the tegulum) (Fig. 5*A*). The base of the embolus is distinctly broader than the embolus itself (EB, embolus base), and in ventral view it is caudal to the conductor base (Fig. 5, 7, 10*A, B*, 20*B*, 38*B*).

The embolus is long, sometimes filiform, circling along the outer margin of the tegulum, in the opposite direction to the



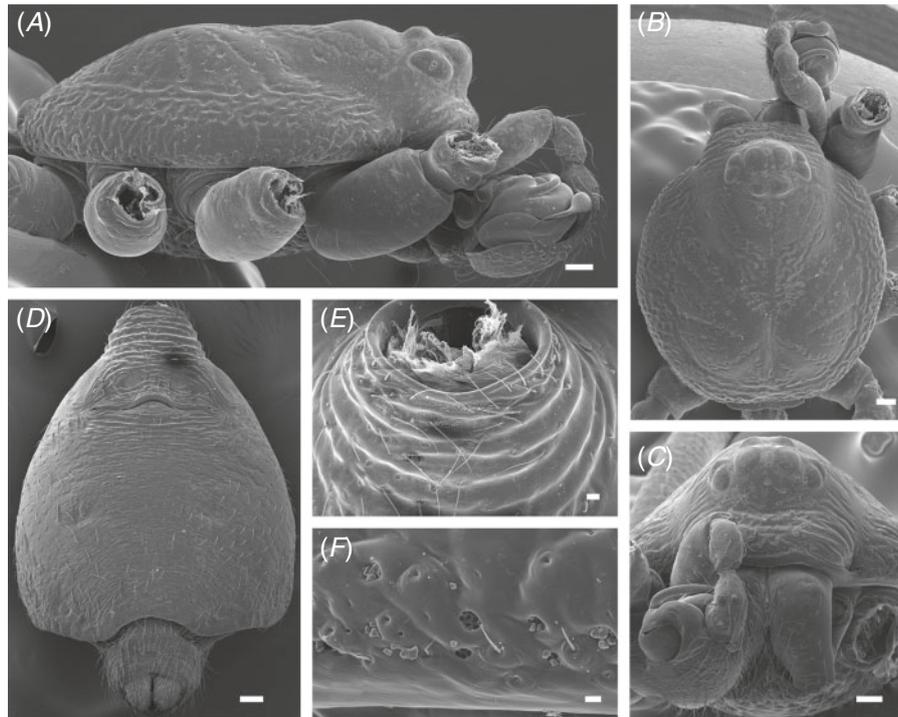
**Fig. 8.** *Chilenodes australis* Platnick & Forster, 1987, spinnerets and epiandrium. *A–C*, Female. *D–F*, Male. *A*, Spinnerets. *B*, ALS. *C*, PMS and PLS. *D*, PMS and PLS. *E*, ALS. *F*, Epiandrium. Scale bars: *A, D, F*, 50  $\mu\text{m}$ ; *B*, 15  $\mu\text{m}$ ; *C, E*, 20  $\mu\text{m}$  (SEMs by Martín J. Ramírez – ATOL Project). Abbreviations: ALS, anterior lateral spinneret; CY, cylindrical gland spigot; MAP, major ampullate spigot; PI, piriform spigot; PMS, posterior median spinneret; PLS, posterior lateral spinneret.

conductor sheath, its apical region resting near the conductor base and its apophyses (Fig. 5, 10, 16, 17). In malkarines, tingotingines and at least some pararchaeines, the spermduct has a loop before entering into the embolus (Fig. 5A, 20A, 26A, 34A, 52A).

#### *Spinneret morphology of Malkaridae*

Malkarids have reduced spinning fields relative to most araneoids, which is undoubtedly linked to the absence of capture webs in this family, although spigot data are available for only a few species. The ALS have a relatively small number of

piriform spigots, less than a dozen, with tartipores, and the piriform field is separated from the major ampullate(s) field by a furrow (Fig. 8, 11); sometimes this separation is very subtle (e.g. in *Ozarchaea harveyi*: Rix and Harvey 2010). There is a single major ampullate spigot, except in pararchaeines, which have two in both sexes, one larger than the other (Rix and Harvey 2010 for *Ozarchaea harveyi*; Rix 2006 for *Flavarchaea* sp.; this is also the case in *Ozarchaea platnicki*). The presence of two major ampullate spigots is very unusual in araneoids, and we are not aware of other instances of paired major ampullate spigots in Araneoidea. The PMS of females have a maximum of three spigots: one cylindrical, one minor ampullate and one aciniform



**Fig. 9.** *Whakamoke paoka*, sp. nov., male. *A*, Prosoma, lateral. *B*, Prosoma, dorsal. *C*, Prosoma, anterior. *D*, Abdomen, ventral. *E*, Abdomen, detail of sclerotised ring around pedicel, anteroventral. *F*, Detail of cuticular pores on carapace margin. Scale bars: *A–D*, 100  $\mu$ m; *E*, 20  $\mu$ m; *F*, 10  $\mu$ m.

spigot (e.g. in *Ozarchaea harveyi*: Rix and Harvey 2010). In some species, there is only one cylindrical and one minor ampullate (e.g. *Carathea parawea*) or just one cylindrical (e.g. *Chilenodes australis* (Fig. 8) or *Ozarchaea platnicki*). The PMS of males range from having no spigots (e.g. *Chilenodes australis* (Fig. 8) or *Ozarchaea platnicki*), two aciniform spigots (*Flavarchaea* sp.: Rix 2006), one minor ampullate spigot (e.g. *Whakamoke paoka*: Fig. 11) or one minor ampullate plus one aciniform spigot (*Ozarchaea harveyi*: Rix and Harvey 2010). The PLS of malkarids lack the araneoid triad (the two flagelliform and one aggregate spigots), which is involved in the spinning of the silk viscid sticky lines (Fig. 8, 11). Females have two cylindrical gland spigots, sometimes accompanied by one or two aciniform spigots. Adult males have one (e.g. *Whakamoke paoka*: Fig. 11) or two (*Ozarchaea harveyi*: Rix and Harvey 2010) aciniform PLS spigots, or no spigots at all (e.g. *Ozarchaea platnicki*). The colulus is fleshy, with 1–3 setae.

In some malkarids, there are striae on the cuticle of the mesal side of the ALS basal segment (e.g. *Chilenodes australis* Platnick & Forster, 1987, fig. 22; Fig. 8; and *Carathea parawea*), suggesting a stridulatory organ, in which case the PMS cylindrical spigot may act as the pick. It should be noted that several species of pararchaeines have stridulatory striae on the ectal side of the paturon (Hickman 1969, fig. 10; Forster and Platnick 1984; Rix 2005, 2006), similar to those found in other spider groups (Archaeidae, Mecysmaucheniidae, Mimetidae, Linyphiidae, etc.: see Hormiga 1994, p. 36 for examples of

cheliceral stridulatory organs) whereas other malkarids have analogous striae in the pedipalpal tarsus (e.g. female palpal tarsus of *Whakamoke poaka*: Fig. 13C, F; male cymbial margin of *Whakamoke heru*: Fig. 16C, 17B).

The arrangement of the epiandrous fusules of malkarids is quite variable, although very little data are available. *Flavarchaea rubra* (Forster, 1949) has the epiandrous fusules in two pits, each with a cluster of three fusules, on both sides of the epigastric furrow (Forster and Platnick 1984, fig. 235, 236). A similar arrangement is found in *Ozarchaea platnicki*. Both *Carathea parawea* and *Chilenodes australis* (Fig. 8F) have only two fusules, medially located, but separate from each other. In *Whakamoke poaka* (Fig. 11F), the fusules, if correctly identified (as they are very similar morphologically to the setae in that abdominal area), are more or less linearly arranged along the margin of the epigastric furrow, approximately eight or nine of them.

## The New Zealand Malkaridae

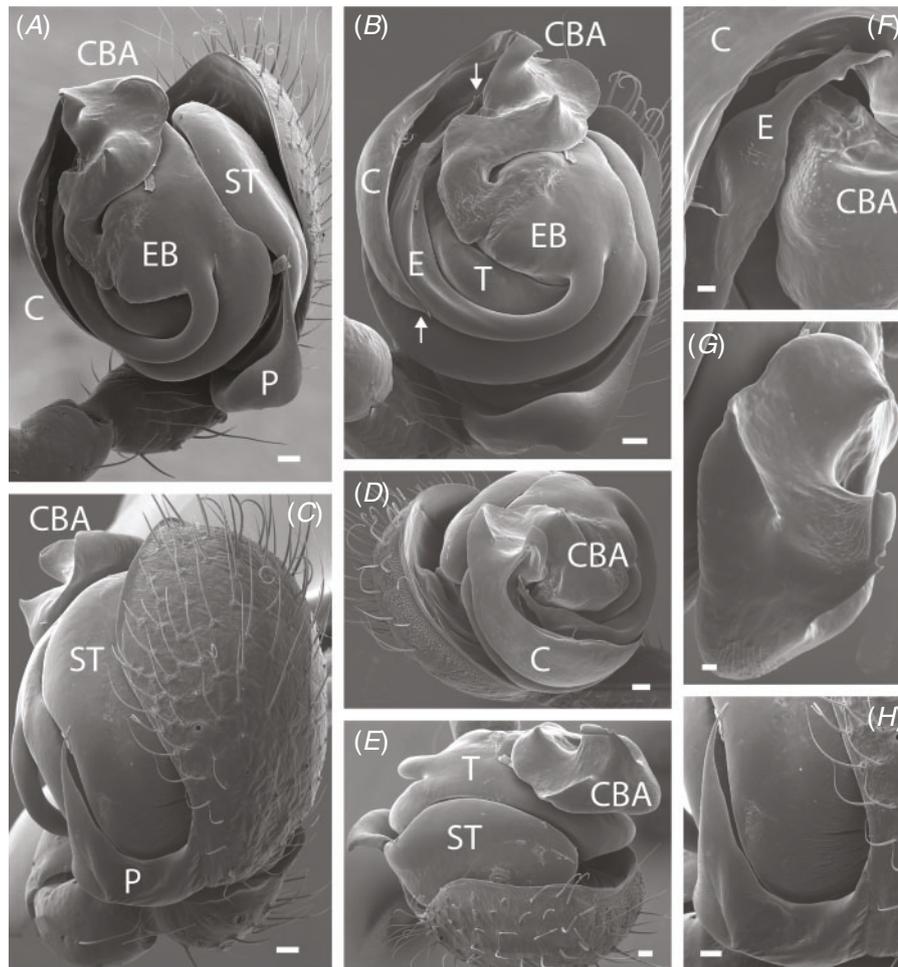
### Subfamily Pararchaeinae Forster & Platnick, 1984

Pararchaeidae Forster and Platnick, 1984: 65 (type *Pararchaea* Forster, 1955).

Pararchaeinae, Eskov, 1987: 90 (considered a subfamily of Archaeidae).

Pararchaeinae (in part) Wunderlich, 2004: 1257 (considered a subfamily of Mimetidae).

Pararchaeini Wunderlich, 2004: 1257 (considered a tribe of Pararchaeinae within Mimetidae).



**Fig. 10.** *Whakamoke paoka*, sp. nov., male palp. *A*, Ectoventral. *B*, Ventral. *C*, Ectoventral. *D*, Apicoventral. *E*, Apical. *F*, Conductor basal apophysis and embolus, apicoventral. *G*, Conductor basal apophysis. *H*, Paracymbium, dorsal. Scale bars: *A–D*, 30  $\mu$ m; *E–H*, 20  $\mu$ m; *F*, *G*, 10  $\mu$ m. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

Pararchaeidae Rix, 2005: 136. – Rix 2006: 204. Paquin *et al.* 2010: 44. Rix and Harvey 2010: 28.

Pararchaeinae Dimitrov *et al.*, 2017: 243 (considered a subfamily of Malkaridae).

#### *Diagnosis (modified from Rix 2006)*

Malkarids with elevated chelicerae arising from a distinct, fully sclerotised foramen in the cephalothorax; pars cephalica steeply elevated from pars thoracica above level of coxae III or IV. Distinguished from both the Archaeidae and the Mecysmaucheniidae by having entelegyne genitalia. Further distinguished from the Archaeidae by the lack of an elongate neck region between the pars cephalica and pars thoracica and from the Mecysmaucheniidae by having six, rather than two, spinnerets. Pararchaeines are distinguished from other malkarids by the presence of cheliceral peg teeth and the elevated pars cephalica and chelicerae and by the absence of a tarsal claw on the female pedipalp.

#### *Composition*

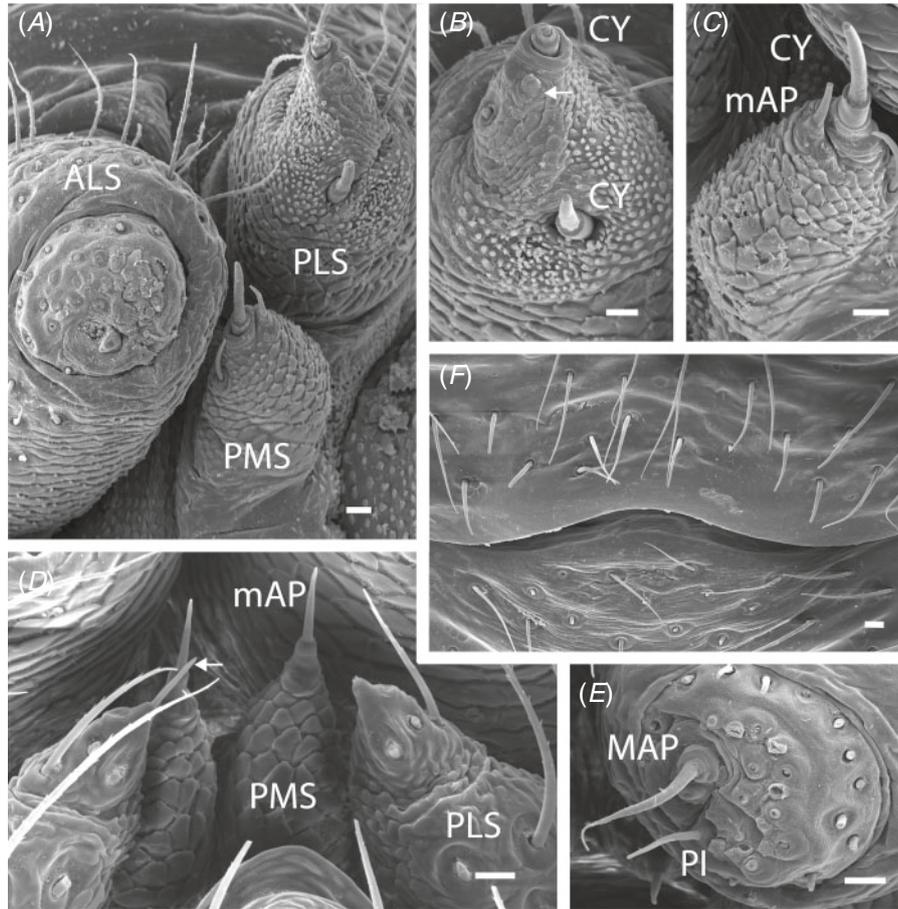
A total of 7 genera and 35 species. *Anarchaea* Rix, 2006; *Flavarchaea* Rix, 2006; *Forstrarchaea* Rix, 2006; *Nanarchaea* Rix, 2006; *Ozarchaea* Rix, 2006; *Pararchaea* Forster, 1955 and *Westrarchaea* Rix, 2006.

#### *Distribution*

Australia, New Zealand, and New Caledonia. Only three species have been described for New Zealand: *Forstrarchaea rubra* (Forster, 1949), *Ozarchaea forsteri* Rix, 2006 and *Pararchaea alba* Forster, 1955.

#### *Natural history*

Primarily found in leaf litter and mosses. Pararchaeine spiders do not build foraging webs and have a remarkable ‘snap-jaw’ mechanism, which seems especially adapted for catching fast-moving prey, as described by Rix (2006):



**Fig. 11.** *Whakamoke paoka*, sp. nov., spinnerets and epiandrium. *A*, Female spinnerets. *B*, Female PLS. *C*, Female PMS. *D*, Male PMS and PLS. *E*, Male ALS. *F*, Epiandrium. Scale bars: 10 µm. Abbreviations: ALS, anterior lateral spinneret; CY, cylindrical gland spigot; mAP, minor ampullate spigot; MAP, major ampullate spigot; PI, piriform spigot; PMS, posterior median spinneret; PLS, posterior lateral spinneret.

Upon contacting potential prey or if a spider perceives a threat, the chelicerae are raised and splayed laterally such that each paturon is directed at right angles to the anterior cephalothorax. This has the result of exposing the peg-teeth, and erecting the ventral cheliceral hairs into an anteriorly directed comb-like formation; each hair is bent and thus upturned in this posture. When a prey item touches this comb of hairs the chelicerae are quickly snapped together with a forward lunge [see also Wood *et al.* 2012].

The egg sacs of two pararchaeine species have been described and illustrated by Rix (2006) and Rix and Harvey (2010). Rix (2006, fig. 146) described the egg sac of *Anarchaea raveni* Rix, 2006 (from Queensland, Australia) as:

a relatively small discoid structure attached to the base/side junction of the container, but was surrounded by an extensive and remarkable silken complex, several times larger than the female that built it. . . This silken complex was composed of two layers: a thin, smooth internal layer,

surrounding the egg sac, and a complex external layer, with multiple lateral ridges.

Rix and Harvey (2010, fig. 35) also described the egg sac of *Ozarchaea westraliensis* Rix, 2006 (from Western Australia), which is similar to that of *Anarchaea raveni*, with:

two discrete protective layers comprising a remarkable silken complex . . . Egg sac proper discoid, circular in dorsal profile, attached to substrate. Inner silken layer covering egg sac, attached to substrate around margins, comprised of fine, mesh-like silk. Outer silken layer complex, starshaped, forming protective three-dimensional 'cap' over inner layer and egg sac'.

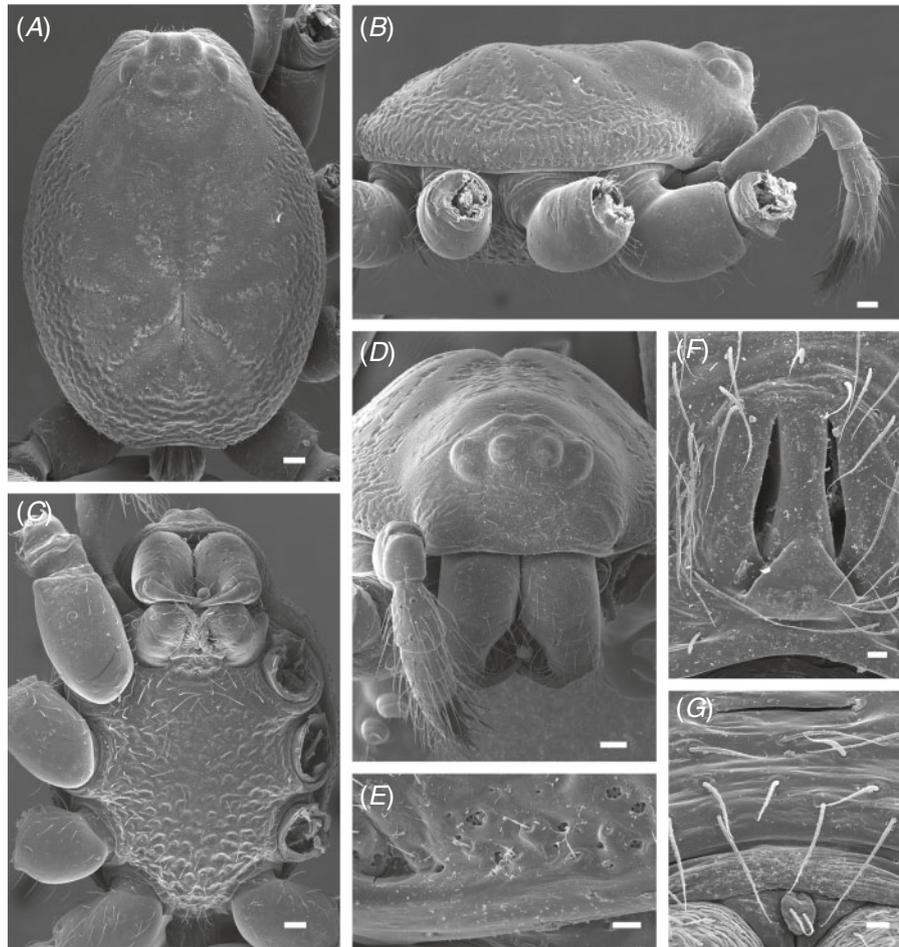
The egg sacs of other malkarids remain unknown.

Genus *Forstrarchaea* Rix, 2006

*Type species: Zearchaea rubra* Forster, 1949 (Rix 2006, p. 221)

*Forstrarchaea rubra* (Forster, 1949)

*Zearchaea rubra* Forster, 1949: 197, fig. 9–15.



**Fig. 12.** *Whakamoke paoka*, sp. nov., female. *A*, Prosoma, dorsal. *B*, Prosoma, lateral. *C*, Prosoma, ventral. *D*, Prosoma, anterior. *E*, Detail of cuticular pores on carapace margin. *F*, Epigynum, ventral. *G*, Tracheal spiracle and colulus, ventral. Scale bars: *A–D*, 100  $\mu$ m; *E–G*, 20  $\mu$ m.

*Pararchaea rubra* Forster, 1955: 402, fig. 24. – Forster and Platnick 1984: 71, fig. 212, 213, 221–229, 235–238.

*Forstrarchaea rubra* Rix, 2006: 222, fig. 16, 57.

The genus *Forstrarchaea* is monotypic and endemic to New Zealand; *F. rubra* is found throughout the northern half of the North Island (Rix 2006).

#### Genus *Ozarchaea* Rix, 2006

*Type species: Pararchaea ornata* Hickman, 1969 (Rix 2006, p. 225)

#### *Ozarchaea forsteri* Rix, 2006

*Ozarchaea forsteri* Rix, 2006: 228, fig. 8, 113.

In Australia, there are 15 species of *Ozarchaea*, from north-eastern Queensland to Tasmania, and in south-western and central Western Australia. The single species described from New Zealand (*O. forsteri*) is known after a single female

specimen from the Pouakai Range, Mount Egmont National Park, on the North Island of New Zealand, at over 1000-m elevation. It was collected within moss and leaf litter (Rix 2006). The male remains unknown.

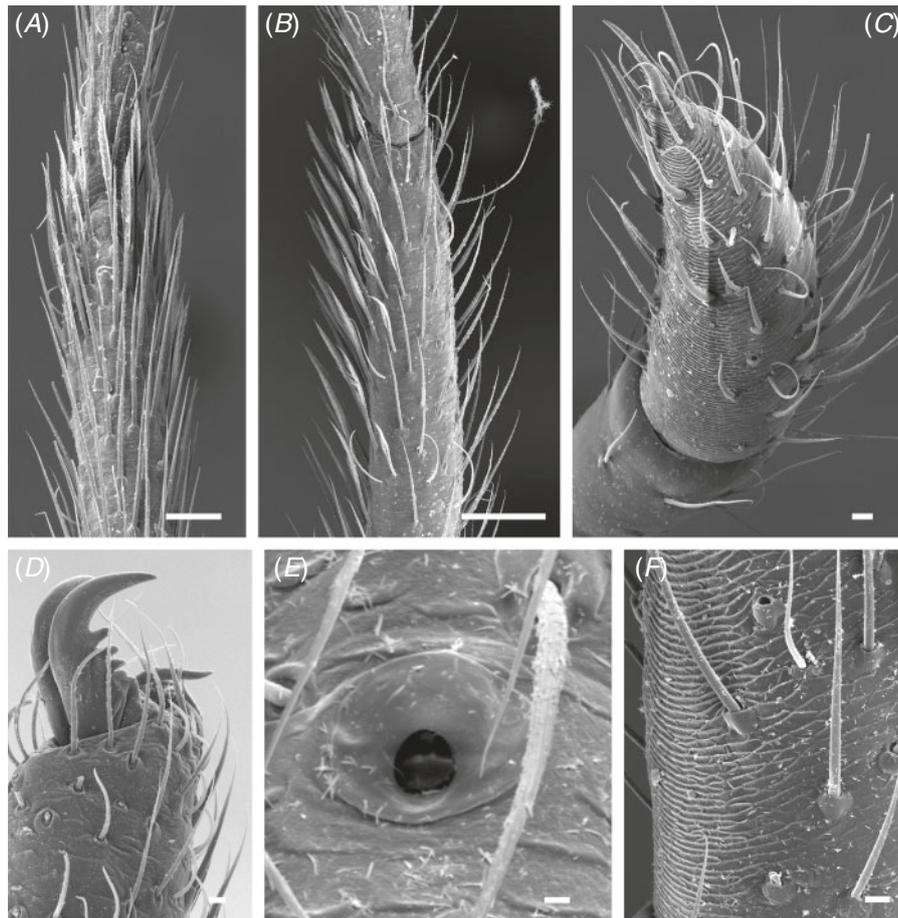
#### Genus *Pararchaea* Forster, 1955

*Type species: Pararchaea alba* Forster, 1955: 397.

#### *Pararchaea alba* Forster, 1955

*Pararchaea alba* Forster, 1955: 399, fig. 1–4, 16–19, 25–26. – Forster and Platnick 1984: 71, fig. 214–219, 230–234, 307. Rix 2006: 245, fig. 15, 56, 128–129. Jocqué and Dippenaar-Schoeman 2006: 198, fig. 76a–f. Paquin *et al.* 2010: 44, fig. 21.1–4.

The genus *Pararchaea* is monotypic; *P. alba* is endemic to New Zealand. Specimens have been collected from mosses, lichens and leaf litter on the southern half of the North Island, throughout the South Island, and on Codfish Island, west of Stewart Island (Rix 2006).



**Fig. 13.** *Whakamoke paoka*, sp. nov., female. A, Metatarsus IV. B, Metatarsus II. C, Pedipalp. D, Tarsal claws, leg I. E, Tarsal organ, leg II. F, Pedipalpal tarsus striae. Scale bars: A, 60  $\mu\text{m}$ ; B, 100  $\mu\text{m}$ ; C, 20  $\mu\text{m}$ ; D–F, 10  $\mu\text{m}$ ; E, 3  $\mu\text{m}$ .

Subfamily **Tingotinginae** Hormiga & Scharff,  
subfam. nov.

*Type genus:* *Tingotingo* Hormiga & Scharff gen. nov.

*Diagnosis*

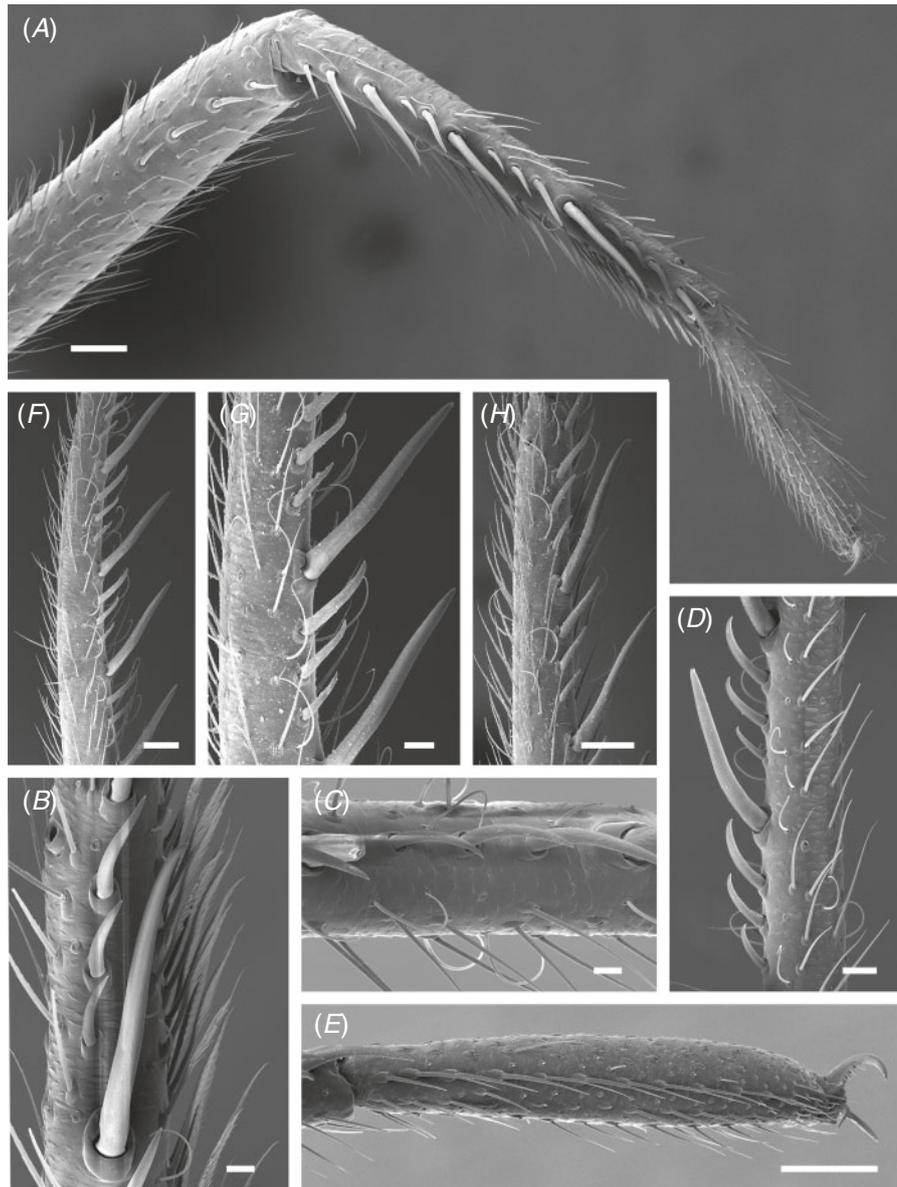
Tingotingines are diagnosed from other New Zealand malkarids by the mimetoid spination pattern of legs I and II found in many species (Fig. 18, 25, 33, 37), their low (not raised) carapace (Fig. 9, 12, 18, 32), the absence of cheliceral peg teeth, their relatively small chelicerae (compared to those of pararchaeines: Fig. 9C, 12D, 18E) and by having the sternum fully encircling the coxal bases, reaching the carapace margin, and projecting caudally into a fully sclerotised ring around the pedicel.

*Composition*

In total, 2 genera and 11 species: *Tingotingo*, gen. nov. and *Whakamoke*, gen. nov.

*Distribution*

Tingotingines are endemic to New Zealand (Fig. 57–59) and most species are found only on one of the three main islands. All *Tingotingo* species are single-island endemics (two species are found in the North Island and two species in the South Island). *Whakamoke guacamole*, sp. nov. is found primarily in the North Island but there are some records from the northern tip of the South Island. Conversely, *W. heru*, sp. nov. is found on the South Island, but there are a few records from the southern tip of the North Island. Tingotingine species can occur sympatrically. For example, three species occur in the Orongorongo Valley in the southern part of the North Island: *T. porotiti*, sp. nov., *W. orongorongo*, sp. nov. and *W. heru*, sp. nov. The Mataitai Forest, in the North Island too, also has three species: *T. tokorera*, sp. nov., *W. tarakina*, sp. nov. and *W. guacamole*, sp. nov. There are some additional cases of sympatry, involving two species, such as Mount Auckland (Atuanui) where *W. guacamole*, sp. nov. occurs along with *W. tarakina*, sp. nov. The existing specimen records of



**Fig. 14.** *Whakamoke paoka*, sp. nov. *A*, Male leg II. *B*, Male metatarsus II. *C*, Male metatarsus I. *D*, Male metatarsus I. *E*, Male tarsus I. *F*, Female metatarsus I. *G*, Female metatarsus I. *H*, Female metatarsus II. Scale bars: *A*, *E*, *F*, *H*, 100  $\mu$ m; *B*, *C*, 20  $\mu$ m; *D*, *G*, 40  $\mu$ m.

Tingotingines do not offer any cases of sympatry on the South Island, although this could be an undersampling artefact. For example, based on the distribution area suggested by the existing specimen records it is possible that *W. heru*, sp. nov. and *T. aho*, sp. nov. co-occur in some areas.

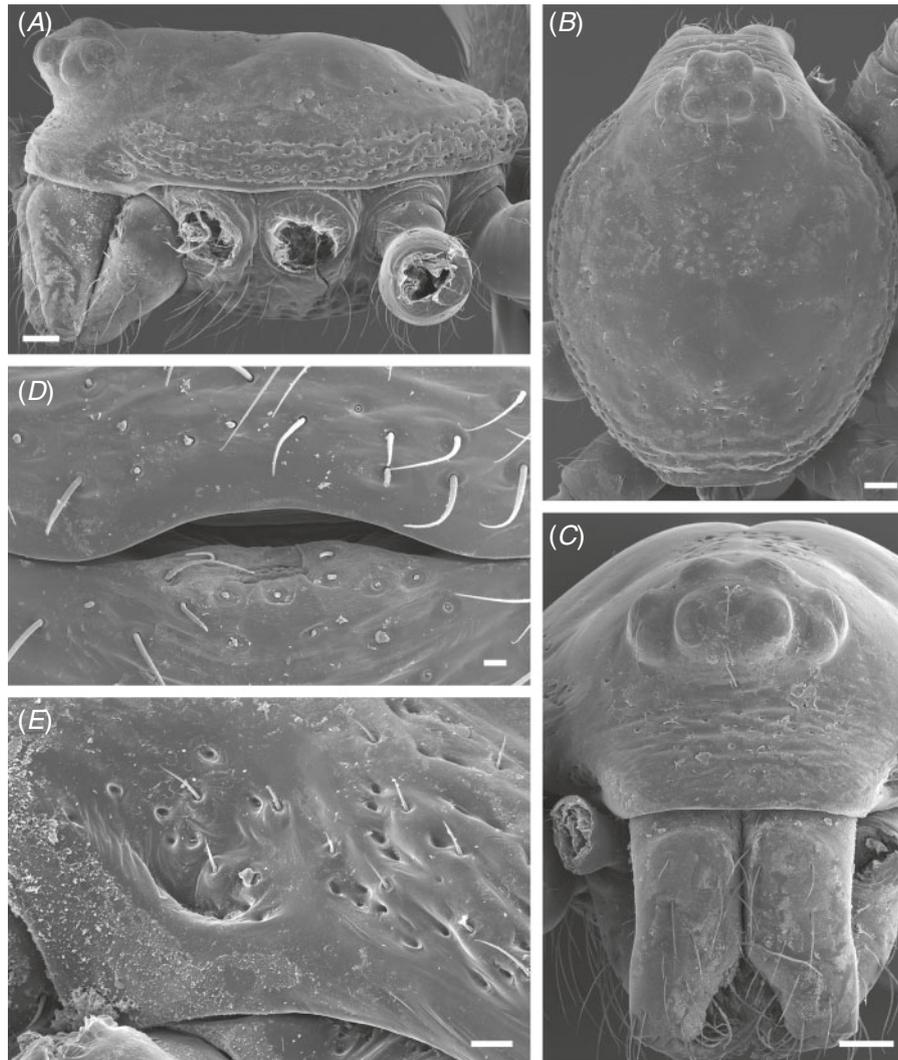
***Tingotingo*** Hormiga & Scharff, gen. nov.

<http://zoobank.org/NomenclaturalActs/921D6177-03DF-465D-B734-0B8A39F6CD1A>

*Type species: Tingotingo porotiti*, sp. nov.

*Diagnosis*

Males of *Tingotingo* are diagnosed by a long and filiform embolus (including the apical region) with a trajectory that does approximately a full circle; the embolus is shorter in *Whakamoke* and its apex is never filiform (Fig. 23, 26, 30). In addition, the spermduct lacks the constriction before entering the embolus (Fig. 20) found in the tegulum of most species of *Whakamoke* (e.g. Fig. 38). In *Tingotingo*, the paracymbium is either bifurcated (Fig. 20, 26) or has some kind of distal process (Fig. 23, 30), whereas in *Whakamoke* the paracymbium is distally acute, without processes (Fig. 34).



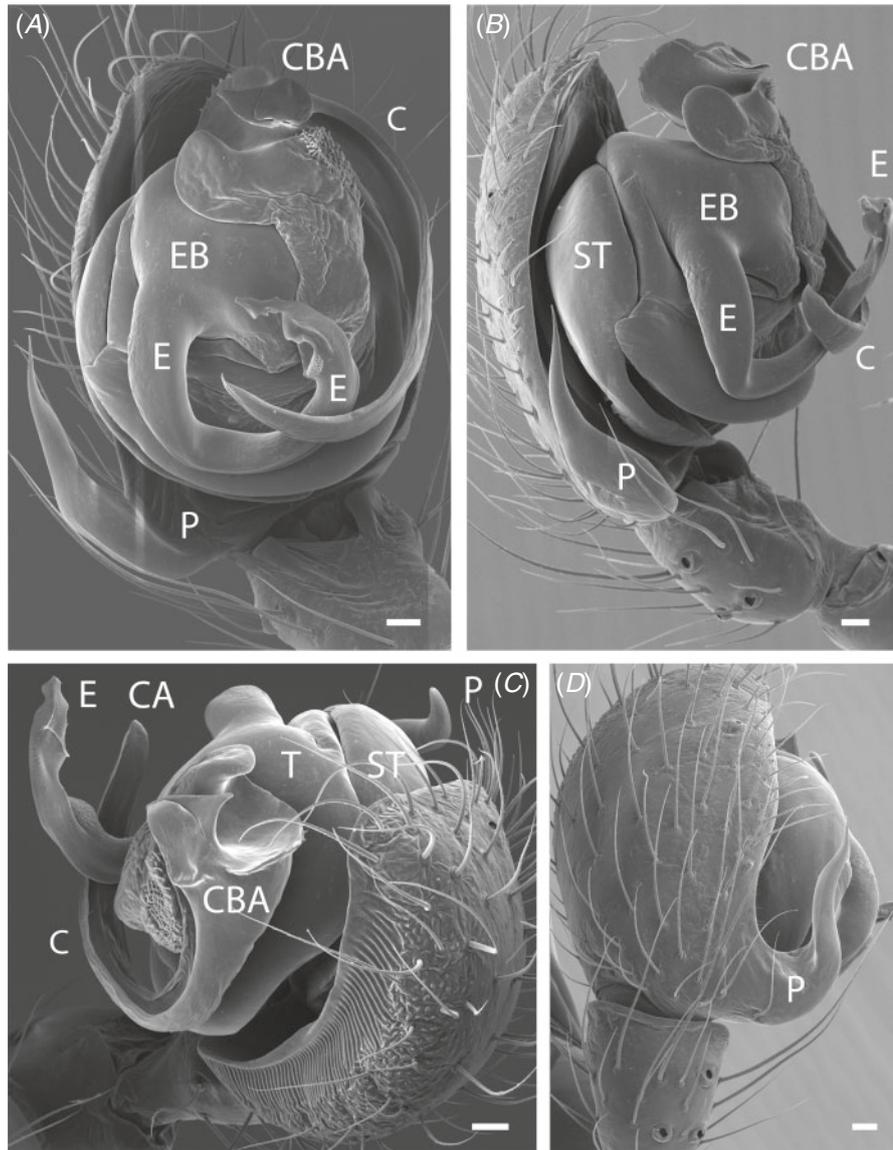
**Fig. 15.** *Whakamoke heru*, sp. nov., male. *A*, Prosoma, lateral. *B*, Prosoma, dorsal. *C*, Prosoma, anterior. *D*, Epiandrium. *E*, Detail of cuticular pores on carapace margin. Scale bars: *A–C*, 100  $\mu\text{m}$ ; *D*, 10  $\mu\text{m}$ ; *E*, 20  $\mu\text{m}$ .

Females of *Tingotingo* are diagnosed by the presence of a closed fenestra on the abdominal scutum, posterior to the epigynum (Fig. 18F); this opening of the scutum is never closed in *Whakamoke* species (see Fig. 38E). The legs of *Tingotingo* species are shorter and thicker than those of *Whakamoke* species, including a short patella and short thick tarsus and metatarsus and the femur I in both sexes is always shorter than the carapace length; in *Whakamoke* the carapace is never longer than femur I.

#### Description

**Male.** Total length 2.37–3.0, cephalothorax length 1.01–1.29, cephalothorax width 0.87–0.96. Cephalothorax dark brown. Abdomen creamy coloured, except scutum (dark brown), covered with numerous small sclerotised discs bearing a seta, same colour as scutum, with two median longitudinal rows of

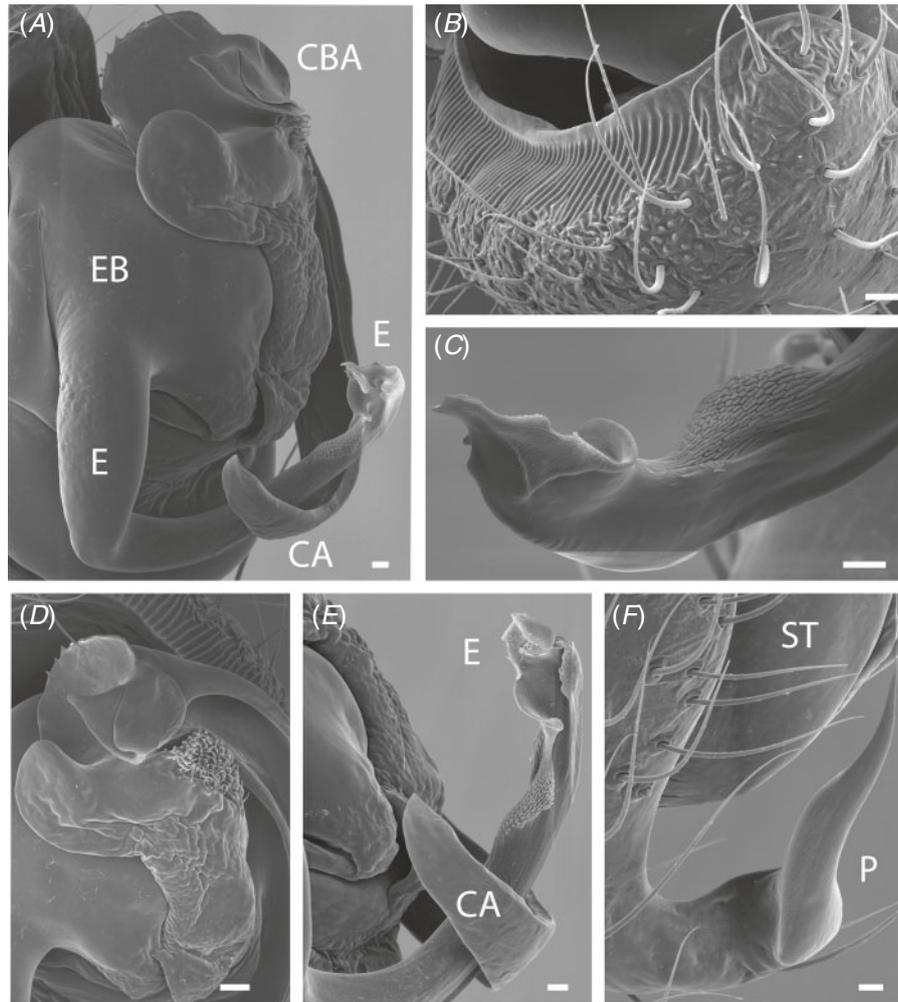
six or seven sigilla, accompanied by several parallel rows of smaller sigilla on both sides (Fig. 18). Abdomen with a heavily sclerotised scutum covering laterally its anterior half and ventrally extending caudally approximately two-thirds of the abdomen length (Fig. 18). Abdominal scutum projects anteriorly into a heavily sclerotised ring encircling the pedicel. Medial epigastric region exposed through a fenestra in the scutum; booklung covers pigmented in darker brown colour (Fig. 18). Spinnerets encircled by a sclerotised ring, which bears a narrow tracheal spiracle. Cephalothorax rectangular in lateral view, without distinction between cephalon and thorax, and with irregularly shaped alveoli along margin and lines radiating from fovea. Posterior margin of cephalothorax with broad elevated ridge. Carapace marginal pit, if present, very subtle, not discernable without SEM examination. Chelicerae with slight proximal swellings anteriorly, with two prolateral and



**Fig. 16.** *Whakamoke heru*, sp. nov., male palp. *A*, Ventral. *B*, Ectal. *C*, Mesoapical. *D*, Dorsal. Scale bars: *A*–*C*, 30  $\mu$ m; *D*, 20  $\mu$ m. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

one (very small) retrolateral teeth. Sternum shield-shaped, covered with irregularly shaped alveoli. Labium wider than long, fused to sternum. Endites longer than wide. Sternum fully encircling coxal bases and reaching carapace margin (pleural membranes not visible), projected caudally into a fully sclerotised ring around the pedicel. AME diameter larger than all other eyes. Clypeus height 2.6–3.4 times one AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed or almost touching. Femur I 0.91–0.95 times length of cephalothorax. Patella long. Tibiae I and II with prolateral macrosetae on distal third of leg segment. Metatarsi I and II with series of prolateral macrosetae in the entire length of the leg segment, spination less

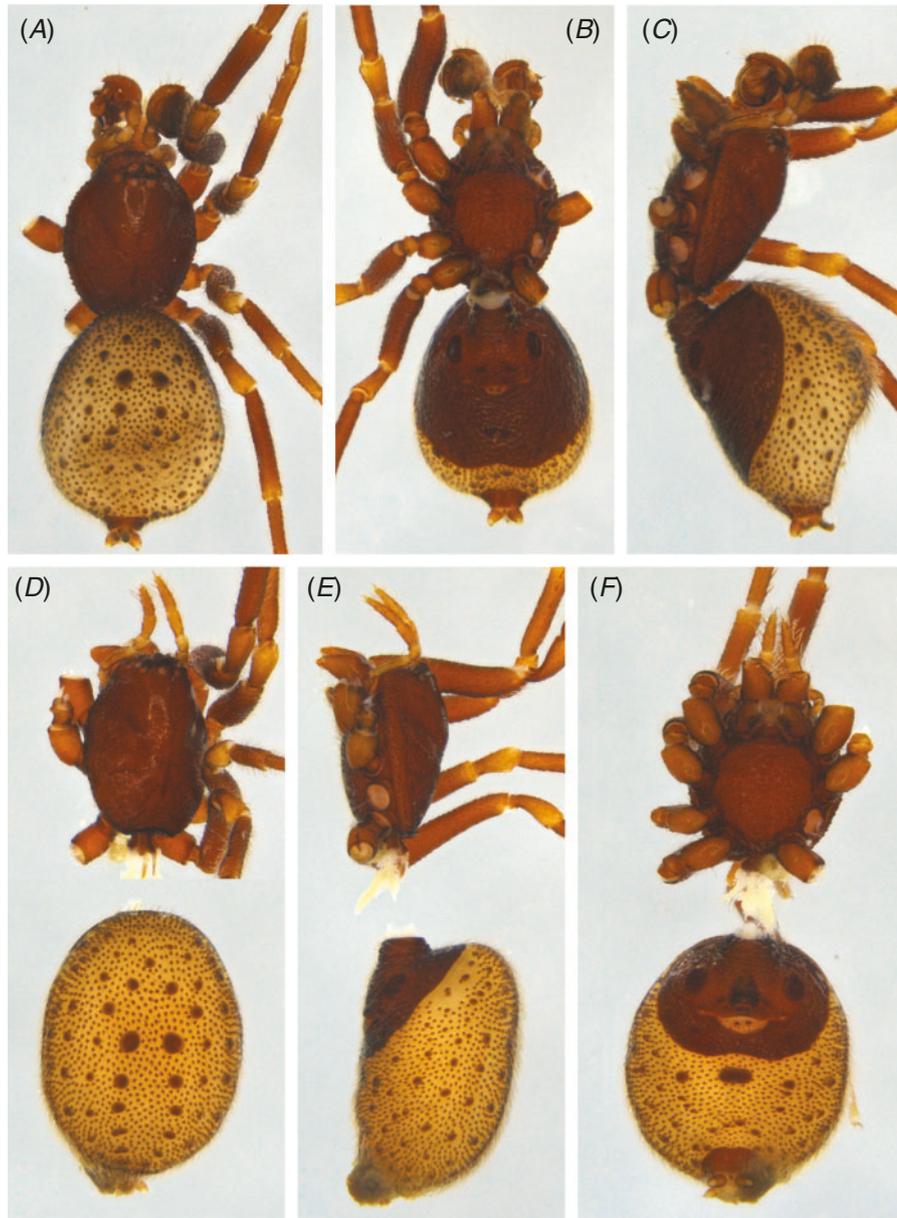
pronounced in males than females. Tarsi I and II short and more or less barrel-shaped, thicker in the middle of the segment and with a large dorsal tarsal organ distally; tarsal organ proximal in III and IV. Tarsi without trichobothria, one distal trichobothrium on metatarsi I–IV. Pedipalp (Fig. 20, 23, 26): tibia unmodified, lacking apophyses, with two to three trichobothria. Cymbium in dorsal view longer than wide, lacking projections or apophyses, tapering towards a blunt apex, with a distal to subdistal tarsal organ. Paracymbium bifurcated or with a distal process. Conductor falciform, running in opposite direction to embolus, with a basal process (CBA). Embolus long and filiform, running approximately a full circle; spermduct lacking a constriction.



**Fig. 17.** *Whakamoke heru*, sp. nov., male palp. *A*, Mesal. *B*, Striae on mesal cymbial margin. *C*, Embolus apical region. *D*, Conductor basal apophysis, ventral. *E*, Embolus and conductor apex. *F*, Paracymbium, dorsal. Scale bars: *A*, *C*, *E*, *F*, 10  $\mu$ m; *B*, *D*, 20  $\mu$ m. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

*Female.* Total length 2.74–3.62, cephalothorax length 1.21–1.48, cephalothorax width 0.90–1.08. Colour as in male. Cephalothorax rectangular in lateral view, without distinction between cephalon and thoracic region, and with few alveoli, mainly along margin and lines radiating from fovea. Abdomen with two median longitudinal rows of six or seven sigilla, accompanied by several parallel rows of smaller sigilla on both sides and a heavily sclerotised scutum covering laterally its anterior half or less and ventrally extending caudally less than half of the abdomen length, beyond the epigastric furrow (Fig. 18, 22, 24). Abdominal scutum projects anteriorly into a heavily sclerotised ring encircling the pedicel, with a caudal fenestra (posterior to the epigynum) with one or two subcuticular discs. Booklung covers pigmented in darker brown colour. Spinnerets encircled by a sclerotised ring with a narrow tracheal spiracle. Tracheal system consisting of two pairs of simple trunks restricted to the abdomen, the lateral trunks being

shorter than the median ones (examined in a *T. porotiti* female from Akatarawa Saddle, Te Papa AS001519). Posterior margin of cephalothorax with broad elevated ridge. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. Sternum shield-shaped, covered with irregularly shaped alveoli. Labium wider than long, fused to sternum. Endites longer than wide. Sternum fully encircling coxal bases and reaching carapace margin (pleural membranes not visible), projected caudally with a fully sclerotised ring around the pedicel. AME diameter larger than all other eyes. Clypeus height 3.1–3.3 times one AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed. Femur I 0.88–0.92 times length of cephalothorax. Patella long. Tibiae I and II with prolateral macrosetae on distal third of leg segment. Metatarsi I and II with series of prolateral macrosetae along the entire length of the leg segment, spination less pronounced in males, compared with



**Fig. 18.** *Tingotingo porotiti*, sp. nov. *A–C*, Male from Orongorongo Valley. *D–F*, Female from Orongorongo Valley. *A*, Dorsal. *B*, Ventral. *C*, Lateral. *D*, Dorsal. *E*, Lateral. *F*, Ventral.

females. Tarsi I and II short and more or less barrel-shaped, thicker in the middle of the segment and with a large dorsal tarsal organ distally; tarsal organ proximal in III and IV. Tarsi without trichobothria, one distal trichobothrium on metatarsi I–IV. Pedipalp with claw, tarsus unmodified. Epigynal region externally inconspicuous (Fig. 21, 27, 31), fully encircled by a highly sclerotised ventral scutum. Copulatory ducts individually encapsulated, spiralling longitudinally anterior from copulatory openings, turning into a descending spiral that connects to the anterior region of longer than wide spermathecae. Fertilisation ducts caudally directed, turning ectally.

#### Composition

*Tingotingo porotiti*, sp. nov., *T. pouaru*, sp. nov., *T. tokorera*, sp. nov., and *T. aho*, sp. nov.

#### Phylogenetics

The species *T. porotiti*, sp. nov. and *T. tokorera*, sp. nov. form a highly supported clade in the molecular analyses of Dimitrov *et al.* (2017) (Fig. 4), sister to the genus *Whakamoke*, gen. nov.

#### Distribution

New Zealand (North and South Islands) (Fig. 57).

### Etymology

The genus name is derived from the Māori adjective *tingotingo* (to be speckled, dotted, spotted), in reference to the dotted appearance of the abdomen of these species. The name is undeclinable and masculine in gender.

### *Tingotingo porotiti* Hormiga & Scharff, sp. nov.

(Fig. 18–21, 57)

<http://zoobank.org/NomenclaturalActs/9BF7CFC3-5735-4510-9E25-60E0418375F0>

### Diagnosis

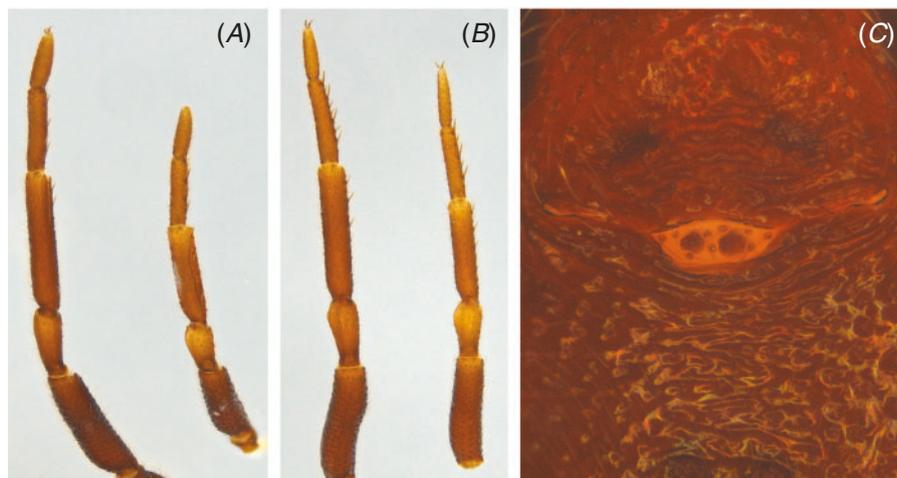
Males of *Tingotingo porotiti* can be distinguished from other New Zealand malkarids by their bifurcated paracymbium (Fig. 20B, D); *T. tokorera* also has a bifurcated paracymbium, but the bifurcation of the latter species is more pronounced and both branches are longer relative to the cymbial length (Fig. 26A–B). The epigyna of these two species are also similar, but, whereas in *T. porotiti* the copulatory ducts are clearly separated (Fig. 21B), in *T. tokorera* the copulatory ducts share a common encapsulation (Fig. 27B).

### Description

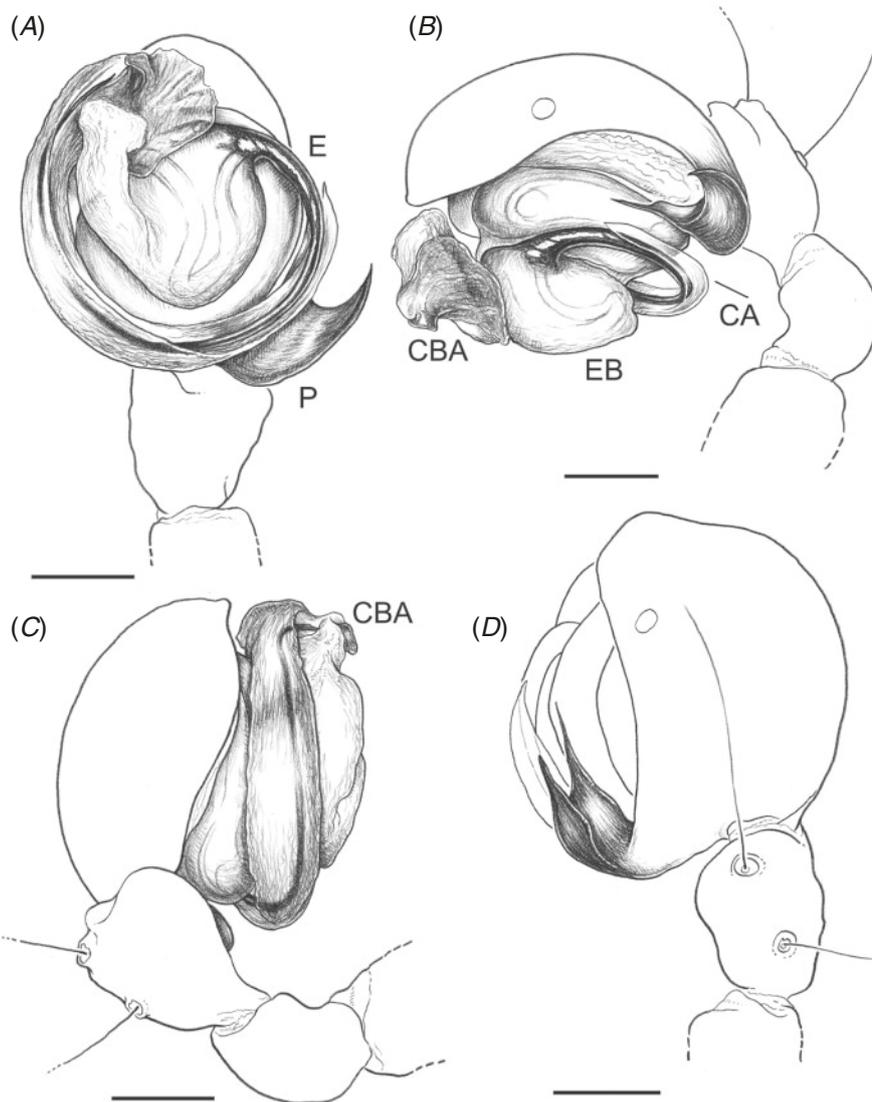
**Male holotype** (from North Island, Orongorongo Valley, MNZ). Total length 2.63. Cephalothorax 1.13 long, 0.87 wide. Sternum 0.74 long, 0.62 wide, shield-shaped. Abdomen 1.64 long, 1.20 wide. Colour as in Fig. 18A–C (preserved specimen). Fovea, a longitudinal line (0.15, not clearly defined), 0.13 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. AME diameter 0.09, larger than all other eyes. Clypeus height 0.28, 3.1 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes almost touching (Fig. 18A, C). Ocular quadrangle same width anteriorly as posteriorly (Fig. 18A). Femur I 1.07 long, 0.95 times length of

cephalothorax. Patella 0.46 long, 0.41 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of prolateral macrosetae along the entire length of the leg segment (Fig. 19A), spination less pronounced in males, compared with females. Spine formula: Tbl 3L, Mtl prox-apic (>4 spines) 4L spines (small spines not obvious); Tbl 2L, Mtl (>3 spines) 3L spines (small spines not obvious). Tarsi I and II short and barrel-shaped, thicker in the middle of the segments. Trichobothrium metatarsus I = 0.90. Tarsal organ = 0.78. Pedipalp (based on another specimen from type locality (14.iv.1995 MNZ, AS. 001510; Fig. 20): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view longer than wide, lacking projections or apophyses, tapering towards a blunt apex (Fig. 20D). Tarsal organ in 0.68 position along longitudinal cymbial axis (Fig. 20B, D). Paracymbium bifurcated, anterior branch ending in a fine point, posterior branch shorter, falciform in ventral view (Fig. 20B, D). Embolus with a large base, filiform, long, almost a complete circle of the tegular perimeter (Fig. 20A). Conductor falciform process covering almost the entire embolus length. CBA with a subtle, blunt sclerotised process, caudally directed in mesal view (Fig. 20C).

**Female paratype** (from North Island, Orongorongo Valley, MNZ). Total length 3.17 (approximation – abdomen detached). Cephalothorax 1.21 long, 0.93 wide. Sternum 0.80 long, 0.65 wide. Abdomen 1.92 long, 1.36 wide. Colour as in Fig. 18D–F (preserved specimen). Fovea, longitudinal line (0.18, not well defined), 0.15 times length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. Sternum shield-shaped, covered with irregularly shaped alveoli (Fig. 18F). AME diameter 0.08, larger than all other eyes. Clypeus height 0.25, 3.1 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 18D–E). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 18D). Pedipalp with claw, tarsus unmodified. Femur I 1.11 long, 0.92 times length of



**Fig. 19.** *Tingotingo porotiti*, sp. nov. **A, C,** Male from Orongorongo Valley. **B,** Female from Orongorongo Valley. **A, B,** Legs I (left) and II (right), dorsal. **C,** Male, epigastric fenestra.



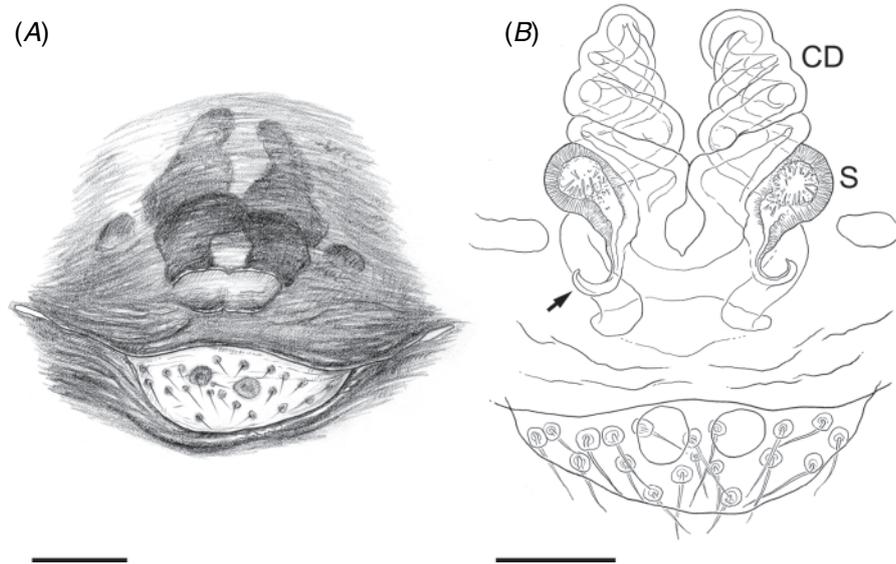
**Fig. 20.** *Tingotingo porotiti*, sp. nov., male palp, specimen from Orongorongo Valley. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

cephalothorax, not particularly swollen in the middle (Fig. 18E). Patella long, 0.49, 0.41 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of prolateral macrosetae along the entire length of the leg segments, more or less of equal length (Fig. 18B). Spine formula: Tbl 3L, Mtl prox-apic (8 spines of almost equal length); Tbl 3L, Mtl (6 spines of almost equal length). Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.85. Tarsal organ = 0.80. Epigynum (based on specimen from Orongorongo Valley, MNZ, Catalogue Number AS.001516): epigynal region externally inconspicuous, fully encircled by a highly

sclerotised ventral scutum with a caudal fenestra with two subcuticular discs (Fig. 21A). Copulatory ducts individually encapsulated, spiralling longitudinally anterior from copulatory openings, turning into a descending spiral that connects to the anterior region of longer than wide spermathecae (Fig. 21B). Fertilisation ducts caudally directed, turning ectally.

#### Variation

*Males*: total length 2.63–3.25 ( $n = 4$ ). Cephalothorax length 1.13–1.29 ( $n = 4$ ), cephalothorax width 0.87–0.95 ( $n = 4$ ). *Females*: total length 2.92–3.17 ( $n = 5$ ). Cephalothorax length 1.13–1.21 ( $n = 5$ ), cephalothorax width 0.91–0.95 ( $n = 5$ ).



**Fig. 21.** *Tingotingo porotiti*, sp. nov., epigynum, specimen from Orongorongo Valley. *A*, Ventral. *B*, Ventral, cleared (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.

### Distribution

New Zealand, North Island. Known only from the southern part of the North Island (Wellington district and southern part of Manawatu–Wanganui district) (Fig. 57).

### Natural history

Specimens have been collected in litter and in pitfall traps in *Nothofagus* forests. Adult males recorded all year round, except July and August. Adult females recorded all year round, except March, July and October.

### Etymology

The species epithet is derived from the Māori word *porotiti* (round, circular), in reference to the numerous sclerotised circular plates that cover the abdomen of this species. The *porotiti* is also a Māori musical instrument consisting of a spinning disc that rotates around two parallel strings. It is played by twirling the string until it spins, creating a humming sound.

### Material examined

**Holotype.** New Zealand, North Island, Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), 18.x.1994, P. Berben & J. Alley leg., hard beech, pitfall trap 10, 1♂ (MNZ).

**Paratype.** New Zealand, North Island, Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), xi.1994, P. Berben & J. Alley leg., hard beech, pitfall traps 4 and 5, 2♀♀ (MNZ).

**Additional material examined.** North Island, Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 15.viii.1995, P. Berben & J. Alley leg., hard beech forest, pitfall 2, ♀ (MNZ, Cat. No. AS.001512); Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), 2.iii.1994, P. Berben & J. Alley leg., hard beech, pitfall trap 4, 1♂ (MNZ); Orongorongo Valley, WN,

41°24'17"S, 174°55'01"E (\*), 30.ix.1994, P. Berben & J. Alley leg., hard beech, pitfall trap 4, 1♀ (MNZ); Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), iv.1994, P. Berben & J. Alley leg., hard beech, pitfall traps 3 and 9, 2♂♂ (MNZ); Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), 15.iii.1994, P. Berben & J. Alley leg., hard beech, pitfall trap 10, 1♂ (MNZ); Orongorongo Valley, WN, 41°24'17"S, 174°55'01"E (\*), 15.xii.1994, P. Berben & J. Alley leg., hard beech, pitfall traps 5 and 10, 1♂1♀ (MNZ); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), 1.ix.1993, B.M. Fitzgerald leg., hard beech forest, pitfall 5, 1♂ (MNZ); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), i.1976, R.R. Forster leg., hard beech forest, pitfall, 1♀ (MNZ); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 14.ii.1992, R.R. Forster leg., hard beech forest, pitfall 2, 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), i.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), v.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 2♂♂ (OM); Orongorongo Res. Stn. Wellington, 41°24'17"S, 174°55'01"E (\*), 21.v.1969, J.S. Dugdale leg., litter 69/134, 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), iv.1976, R.R. Forster leg., pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), v.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 2♂♂ (OM); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1.vi.1992, R.R. Forster leg., hard beech forest, pit 3, 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), v.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), i.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), iv.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), i.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), v.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S, 174°55'01"E (\*), iv.1976, R.R. Forster leg., broadleaf forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, Wellington, 41°24'17"S,

174°55'01"E (\*), ii.1976, R.R. Forster leg., hard beech forest, pitfall Ecol. Divn., 1♂ (OM); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 14.v.1993, R.R. Forster leg., hard beech forest, pit 6, 1♂ (OM); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1.ii.1996, P. Berben & J. Alley leg., hard beech forest, pitfall 5, 1♀ (MNZ, Cat. No. AS.001516); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1.ix.1995, P. Berben & J. Alley leg., hard beech forest, pitfall 8, 1♂ (MNZ, Cat. No. AS.001513); Akatarawa Saddle, 41°4'44"S, 175°6'29"E (\*), 11.v–01.vi.1999, P.H. Berben leg., hardwood forest, pitfall 400–540 m ASL, 2♀♀ (MNZ, Cat. No. AS.001519); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1. iv.1996, P. Berben & J. Alley leg., hard beech forest, pitfall 6, 1♀ (MNZ, Cat. No. AS.001517); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 14. ii.1996, P. Berben & J. Alley leg., hard beech forest, pitfall 1, 1♂1♀ (MNZ, Cat. No. AS.001515); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 14. iv.1995, P. Berben & J. Alley leg., hard beech forest, pitfall 5, 1♂ (MNZ, Cat. No. AS.001510); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 16. i.1996, P. Berben & J. Alley leg., hard beech forest, pitfall 4, 1♂ (MNZ, Cat. No. AS.001514); Akatarawa Saddle, 41°4'44"S, 175°6'29"E (\*), 18. v–02.vi.2000, P.H. Berben leg., hardwood forest, pitfall, 400–540 m ASL, 1♂ (MNZ, Cat. No. AS.001520); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 30.vi.1995, P. Berben & J. Alley leg., hard beech forest, pitfall 4, 1♀ (MNZ, Cat. No. AS.001511); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 16. iv.1996, P. Berben & J. Alley leg., hard beech forest, pitfall 4, 1♂ (MNZ, Cat. No. AS.001518); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1. i.1995, P. Berben & J. Alley leg., hard beech,

pitfall trap, 1♂ (MNZ, Cat. No. AS.002338); WN Levin Kimberly Reserve, S40°39'57", E175°19'04" (\*), 6.xi.1980, C.F. Butcher leg., litter, 1♂ (NZAC); C.L. Pemberton Memorial Scenic Reserve, S39°52'41.4", E175°55'3.7", 16. iv.2011, N. Scharff & G. Hormiga leg., native forest, sifted leaf litter, 558 m ASL, 1♀ (ZMUC).

*Tingotingo pouaru* Hormiga & Scharff, sp. nov.

(Fig. 22, 23, 57)

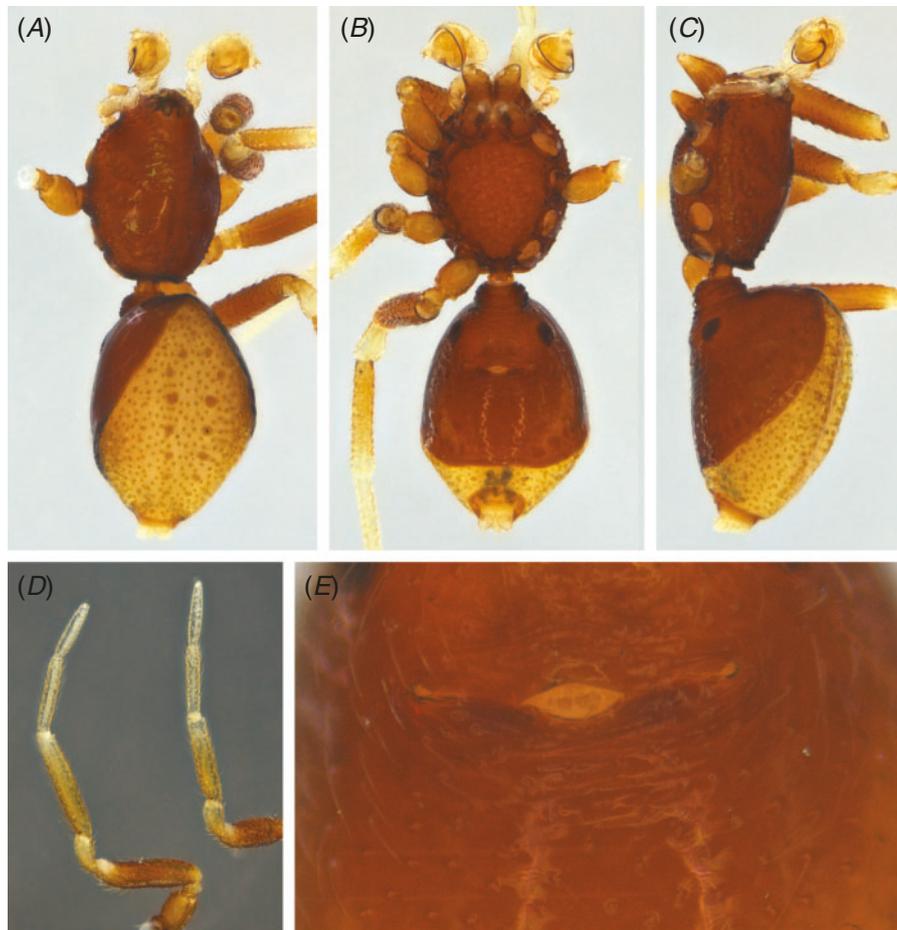
<http://zoobank.org/NomenclaturalActs/E858756E-11E2-4144-BA44-AD8FBBFAC3EE>

*Diagnosis*

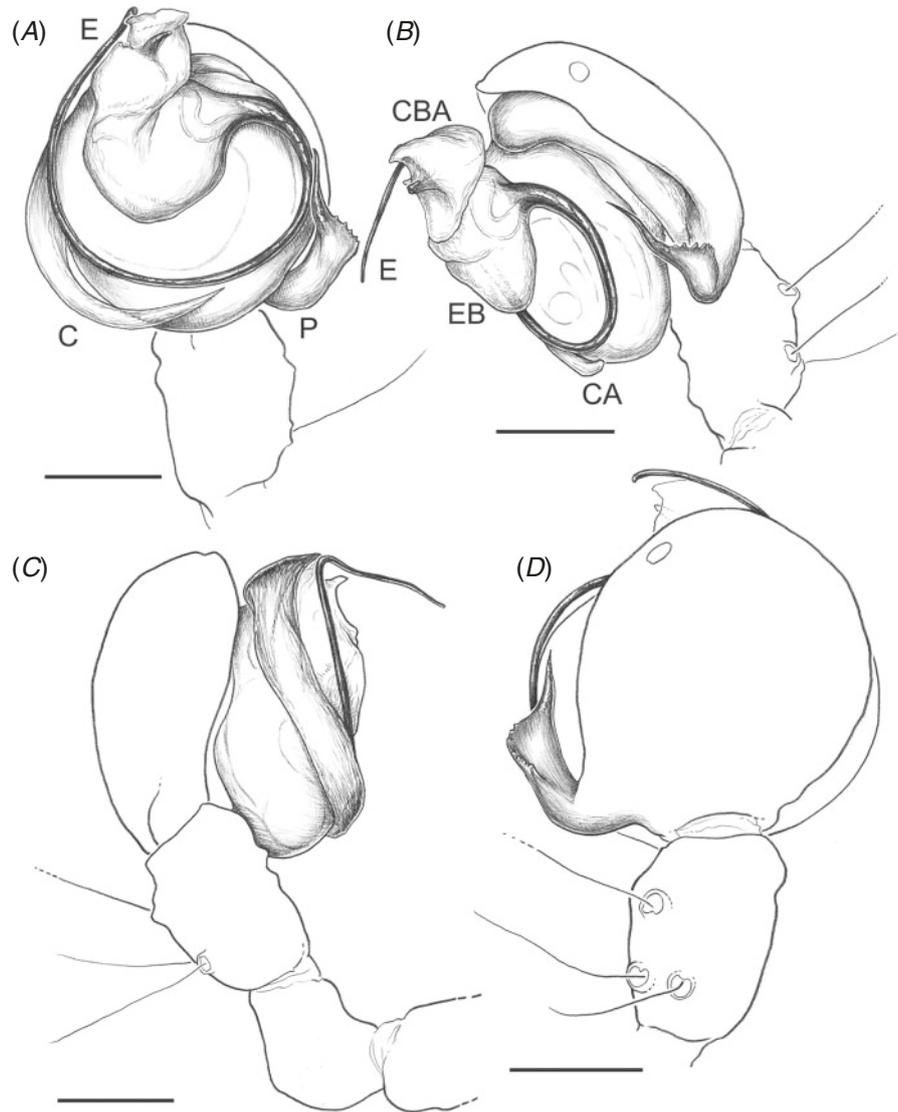
Males of *Tingotingo pouaru* are similar to those of *T. aho* and uniquely diagnosed by the long and filiform embolus combined with a medially serrated paracymbium that ends in a long and fine point (Fig. 23A, B); the paracymbium of *T. aho* has fewer serrations and a blunt apex (Fig. 28D). The females of this species are unknown.

*Description*

*Male holotype* (from Globe Hill, Reefton, MNZ, Cat. No. AS.001504). Total length 2.37. Cephalothorax 1.01 long,



**Fig. 22.** *Tingotingo pouaru*, sp. nov., male from Globe Hill, Reefton. A, Dorsal. B, Ventral. C, Lateral. D, Legs I (left) and II (right). E, Epigastric fenestra.



**Fig. 23.** *Tingotingo pouaru*, sp. nov., male palp, specimen from Globe Hill, Reefton. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

0.73 wide. Sternum 0.68 long, 0.54 wide, shield-shaped. Abdomen 1.29 long, 0.85 wide. Colour as in Fig. 22A–C (preserved specimen). Fovea, longitudinal line (0.25), 0.25 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. Sternum shield-shaped, covered with irregularly shaped alveoli (Fig. 22B). AME diameter 0.08, larger than all other eyes. Clypeus height 0.21, 2.6 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 22A). Ocular quadrangle same width anteriorly as posteriorly (Fig. 22A). Femur I 0.92 long, 0.91 times length of cephalothorax. Patella long, 0.39, 0.39 times length of cephalothorax. Tibiae and metatarsi I and II short

and thick. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of prolateral macrosetae along the entire length of the leg segments (macrosetae of legs I and II are less pronounced than in other species). Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.90. Tarsal organ = 0.83. Pedipalp (from Globe Hill, Reefton, MNZ, AS.001502) (Fig. 23): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium apically rounded in dorsal view (Fig. 23D). Tarsal organ in 0.85 position along longitudinal cymbial axis (Fig. 23C, D). Paracymbium thin and pointed apically, its medial margin serrated. Embolus long, filiform, completely circling the tegular perimeter Fig. 23A–B).

Conductor falciform, apically pointed (Fig. 23C), covering approximately two-thirds of the embolus length. CBA with a small pointed sclerotised process (Fig. 23B).

#### Variation

*Males*: total length 2.37–2.59 ( $n = 4$ ). Cephalothorax length 1.01–1.16 ( $n = 4$ ), cephalothorax width 0.71–0.78 ( $n = 4$ ).

#### Distribution

New Zealand, South Island. Known only from the type locality at Globe Hill, Reefton (Fig. 57).

#### Natural history

The few specimens known have been collected in pitfall traps in hard beech forest (*Nothofagus truncata*). Females not yet known. Adult males recorded from January to April.

#### Etymology

The species epithet is taken from the Māori word for widower (*pouaru*), given that the females of this species remain unknown.

#### Material examined

*Holotype*. New Zealand, South Island, Globe Hill, Reefton, 42°6'22"S, 171°50'59"E (\*), 22.i–22.iv.1993, M.J. Meads leg., hard beech forest, pitfall 26, 1♂ (MNZ, Cat. No. AS.001504).

*Additional material examined*. South Island, Globe Hill, Reefton, 42°6'22"S, 171°50'59"E (\*), 21.i–22.iv.1993, M.J. Meads leg., forest, pitfall 16, 2♂♂ (MNZ, Cat. No. AS.001503); Globe Hill, Reefton, 42°6'22"S, 171°50'59"E (\*), 21.i–22.iv.1993, M.J. Meads leg., pole beech forest, pitfall 6c, 1♂ (MNZ, Cat. No. AS.001502).

### *Tingotingo tokorera* Hormiga & Scharff, sp. nov.

(Fig. 2D, 24–27, 57)

<http://zoobank.org/NomenclaturalActs/C33D82E3-DF6D-4A7C-A933-52B25C190859>

Malkarinae sp. a. Paquin *et al.*, 2010: 40, fig. 17.1, 17.3, 17.4.

#### Diagnosis

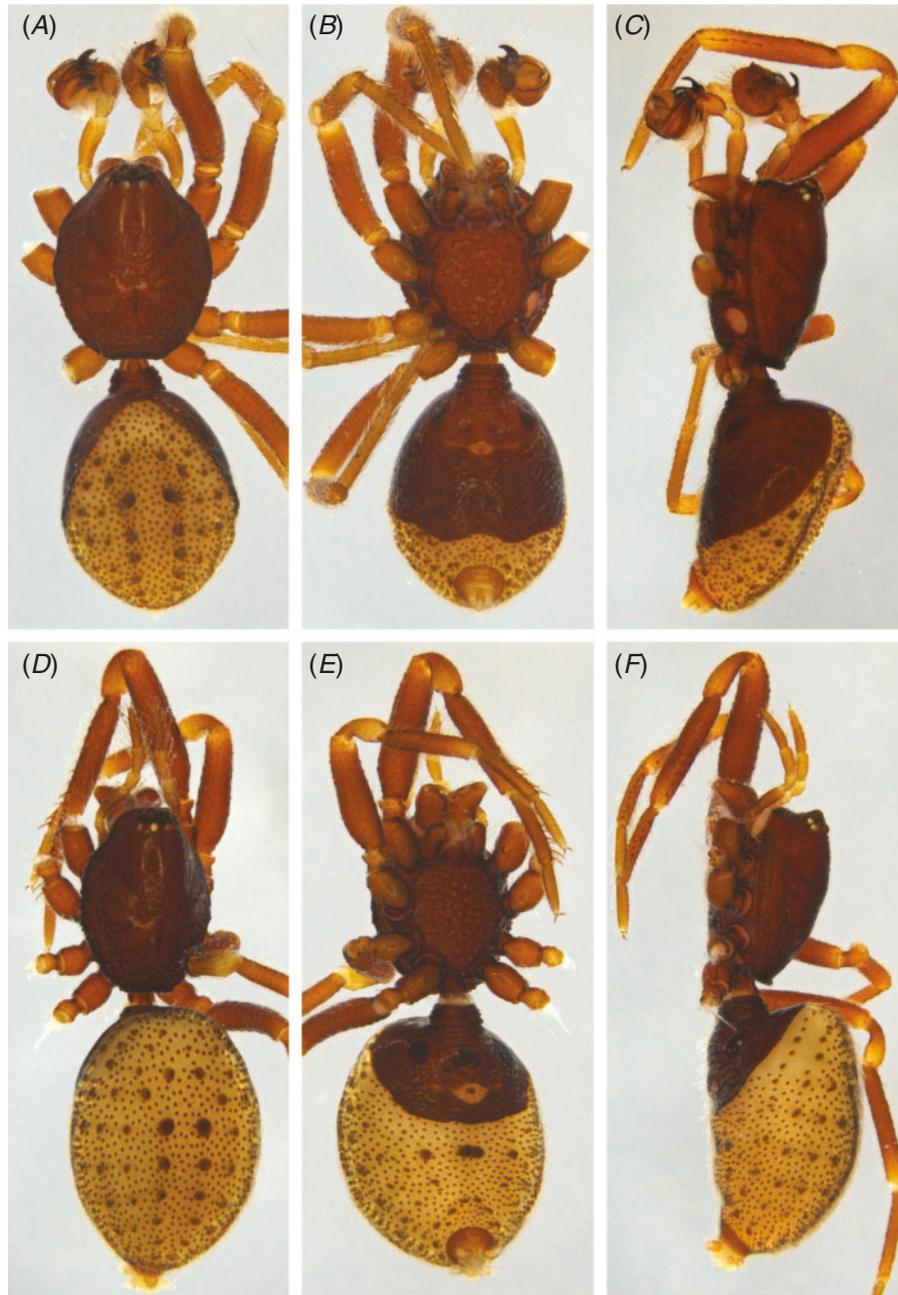
Males of *Tingotingo tokorera* can be distinguished from other New Zealand malkarids by their strongly bifurcated paracymbium (Fig. 26A, B); *T. porotiti* also has a bifurcated paracymbium, but in the latter species the bifurcation is subtler and both branches are shorter relative to the cymbial length (Fig. 20A, B). The epigyna of these two species are also similar, but, whereas in *T. tokorera* the copulatory ducts share a common encapsulation (Fig. 27B), in *T. porotiti* the copulatory ducts are clearly separated (Fig. 21B).

#### Description

*Male holotype* (from North Island, Taranaki, Tarata, MNZ, Catalogue Number AS.001493). Total length 2.73. Cephalothorax 1.19 long, 0.91 wide. Sternum 0.78 long, 0.57 wide, shield-shaped. Abdomen 1.38 long, 1.04 wide. Colour as in Fig. 24A–C (preserved specimen). Fovea, longitudinal line (0.22), 0.19 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral

and one (very small) retrolateral teeth. AME diameter 0.08, larger than all other eyes. Clypeus height 0.27, 3.4 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes almost touching (Fig. 24A, C). Ocular quadrangle same width anteriorly as posteriorly (Fig. 24A). Femur I 1.08 long, 0.91 times length of cephalothorax. Patella long, 0.43, 0.36 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segment (Fig. 25A), spination less pronounced in males, compared with females; spine formula: Tbl 5L, Mtl prox-apic (7 spines) 1L1s1L1s1L2s; Tbl 4L, Mtl (8 spines) 1L1s1L2s1L1s1L. Tarsi I and II barrel-shaped, thicker in the middle. Trichobothrium metatarsus I = 0.88. Tarsal organ = 0.83. Pedipalp (based on male from Mount Moehau, NZAC, Bag #92170) (Fig. 26): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view longer than wide, lacking projections or apophyses, tapering towards the apex (Fig. 26D). Tarsal organ in 0.71 position along longitudinal cymbial axis (Fig. 26B, D). Paracymbium bifurcated, anterior branch ending in a fine point, posterior branch shorter, spatulate (Fig. 26A). Embolus with a large base, filiform, long, almost a complete circle of the tegular perimeter. Conductor falciform process covering almost the entire embolus length (Fig. 26A). CBA with a pointed sclerotised process, caudally directed in mesal view (Fig. 26C).

*Female paratype* (from North Island, Taranaki, Tarata, Catalogue Number AS.001493). Total length 3.24. Cephalothorax 1.26 long, 0.95 wide. Sternum 0.79 long, 0.63 wide. Abdomen 1.84 long, 1.34 wide. Colour as in Fig. 24D–F (preserved specimen). Fovea, longitudinal line (0.21 long), 0.17 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. AME diameter 0.08, larger than all other eyes. Clypeus height 0.26, 3.3 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes almost touching (Fig. 24D, F). Ocular area equally wide anteriorly and posteriorly (Fig. 24D). Pedipalp with claw, tarsus unmodified. Femur I 1.11 long, 0.88 times length of cephalothorax, not particularly swollen in the middle (Fig. 24F). Patella long, 0.47, 0.37 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 25B). Spine formula: Tbl 5L, Mtl prox-apic (9 spines) 1L1s1L2s1L1s2L; Tbl 4L, Mtl (8 spines) 1L1s1L2s1L1s1L. Tarsi I and II barrel-shaped, thicker in the middle of the segments than at the ends. Trichobothrium metatarsus I = 0.88. Tarsal organ = 0.80. Epigynum (based on female from Mataitai Forest, MNZ, Catalogue Number AMNZ 66314). Epigynal region externally inconspicuous, fully encircled by a highly sclerotised ventral scutum with a caudal fenestra anteriorly indented and with a single subcuticular disc (Fig. 27A). Copulatory ducts encapsulated, spiralling longitudinally anteriorly from copulatory openings, turning into a



**Fig. 24.** *Tingotingo tokorera*, sp. nov. *A–C*, Male from Taranaki, Tarata. *D–F*, Female from Taranaki, Tarata. *A*, Dorsal. *B*, Ventral. *C*, Lateral. *D*, Dorsal. *E*, Ventral. *F*, Lateral.

descending spiral that connects to the anterior region of longer than wide spermathecae (Fig. 27*B*). Fertilisation ducts caudally directed, turning ectally.

#### Variation

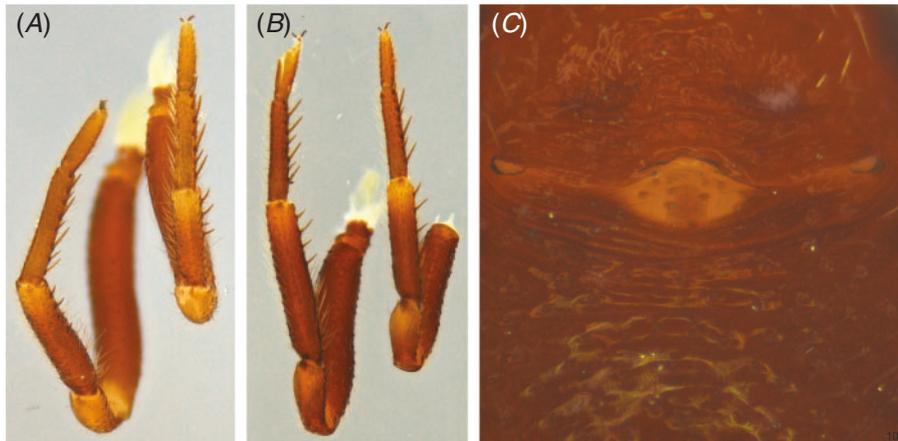
*Males*: total length 2.44–2.73 ( $n = 4$ ). Cephalothorax length 1.14–1.21 ( $n = 4$ ), cephalothorax width 0.91–0.96 ( $n = 4$ ). *Females*: total length 2.74–3.54 ( $n = 4$ ). Cephalothorax length 1.23–1.45 ( $n = 4$ ), cephalothorax width 0.95–1.08 ( $n = 4$ ).

#### Distribution

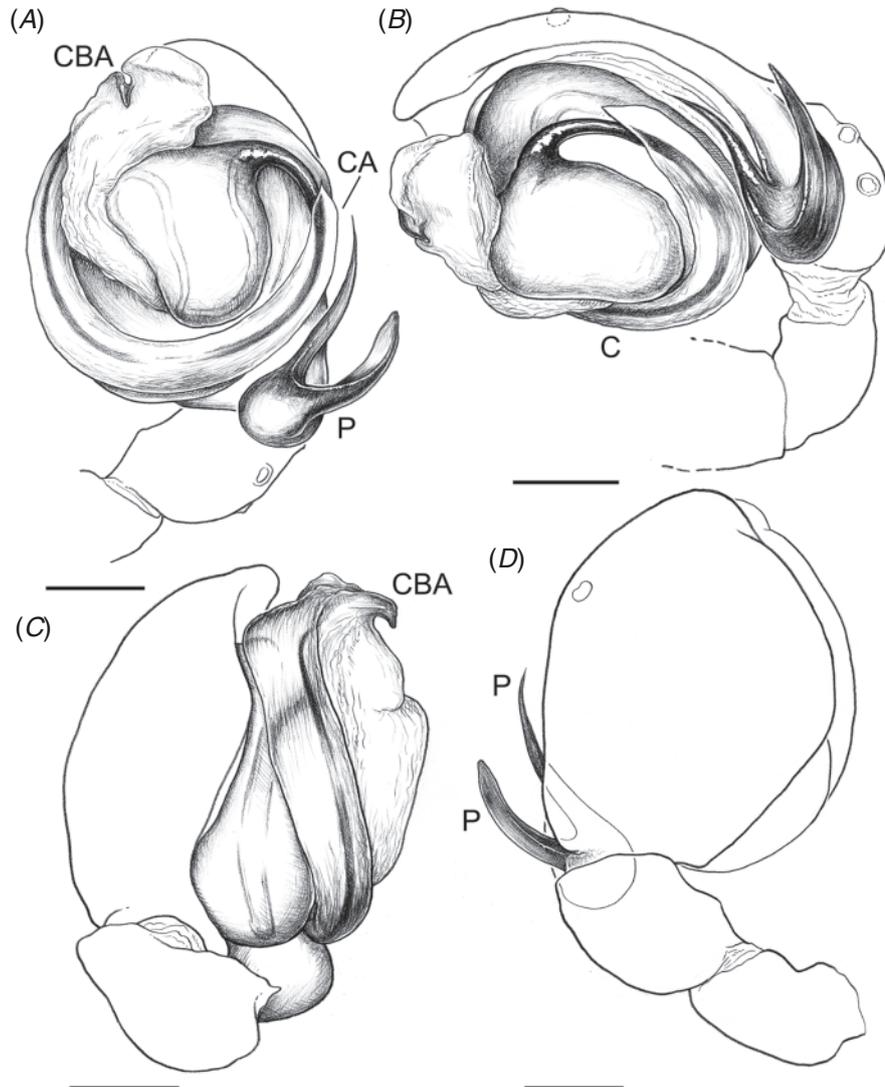
New Zealand, North Island. Relatively widespread with records from northern, eastern and western parts of the island (Fig. 57).

#### Natural history

Specimens have been collected in litter, in moss, in decayed wood, and in pitfall traps in mixed and broadleaf forests. Adult males recorded from January–May, July and



**Fig. 25.** *Tingotingo tokorera*, sp. nov. *A, C*, Male from Taranaki, Tarata. *B*, Female from Taranaki, Tarata. *A, B*, Legs I (left) and II (right), dorsal. *C*, Male, epigastric fenestra.



**Fig. 26.** *Tingotingo tokorera*, sp. nov., male palp, specimen from Mount Moehau. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

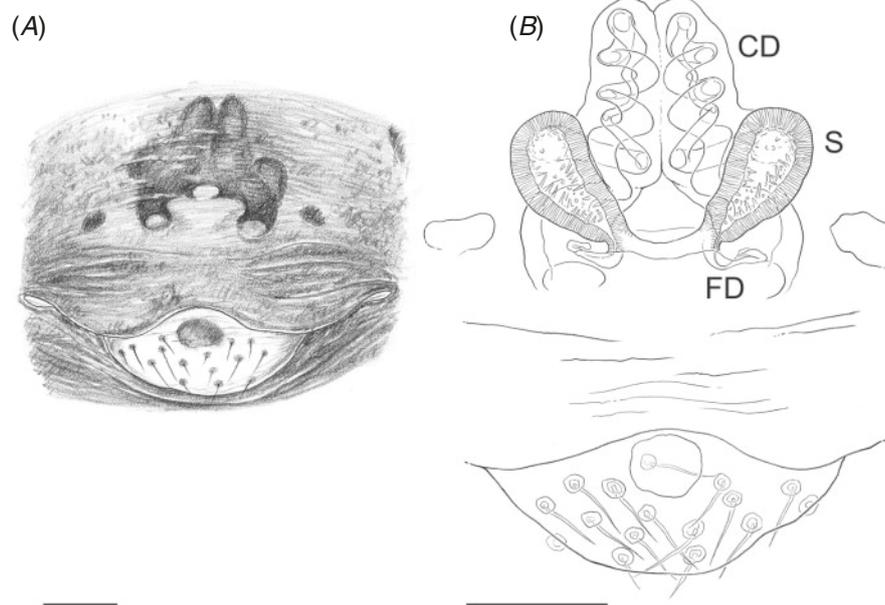


Fig. 27. *Tingotingo tokorera*, sp. nov., epigynum, specimen from Mataitai Forest. A, Ventral. B, Dorsal, cleared. Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; FD, fertilisation duct; S, spermatheca.

October–December. Adult females from January–April, July–August and October–December.

### *Etymology*

The species epithet is taken from the Māori word for forked, in reference to the bifurcated paracymbium of this species.

### *Material examined*

*Holotype.* New Zealand, North Island, Taranaki, Tarata, 39°9'5''S, 174°21'48''E (\*), 24.vii.1996, J. Clark leg., 1♂ (MNZ, Cat. No. AS.001493).

*Paratype.* Together with holotype male, 1♀ (MNZ, Cat. No. AS.001493).

*Additional material examined.* North Island, Whitecliffs, 38°49'55''S, 174°35'13''E (\*), 31.i.1992, L. Stanley leg., pitfall 3, 1♂ (MNZ, Cat. No. AS.001491); Whitecliffs, 38°49'55''S, 174°35'13''E (\*), 31.i.1993, L. Stanley leg., pitfall 8, 1♀ (MNZ, Cat. No. AS.001489); CL, Coromandel, Tapu Coroglen Rd, Square Kauri, 36°59'25.83''S, 175°34'19.67''E, 3.iv.2011, A. Schomann & J. Pedersen leg., mixed forest, sifted litter, 330 m ASL, 1♀ (ZMUC); Great Barrier I, Te Paparahi, 36°10'S, 175°23'E (\*), i.2002, A. Warren leg., Pifall B23, 1♀ (AWMM, Cat. No. AMNZ66130); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall B11, 1♂ (AWMM, Cat. No. AMNZ66136); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), i.2002, A. Warren leg., pitfall C25, 1♀ (AWMM, Cat. No. AMNZ66314); Whitecliffs, 38°49'55''S, 174°35'13''E (\*), 31.iii.1992, L. Stanley leg., 1♂ (MNZ, Cat. No. AS.001492); Whitecliffs, 38°49'55''S, 174°35'13''E (\*), 30.xi.1991, L. Stanley leg., pitfall 2, 1♀ (MNZ, Cat. No. AS.001490); Kerr-Taylor Reserve, S37°42'41'', E176°19'44'' (\*), 10–17.ii.1999, P. Paquin & N. Duperre leg., pitfall, 1♀ (NZAC); CL, Waikawau Bay, 36°36'11''S, 175°31'41''E (\*), 22.xi.1993, A. Larochelle & M.C. Larivière leg., 1♀ (NZAC); TO, Ohakune Mt Rd Tk to Blyth Hut, 39°12'0''S, 175°32'18''E (\*), 27.xi.1985, R.C. Craw leg., litter and moss, 1219 m ASL, 1♂ (NZAC); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 8–15.xii.1998, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♂ (NZAC);

Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 15–22.xii.1998, Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♂1♀ (NZAC); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 22–29.xii.1998, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♂ (NZAC); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 22–29.xii.1998, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♂ (NZAC); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 23–30.iii.1999, P. Paquin & N. Duperre leg., 1♀ (NZAC); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 15–22.xii.1998, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♀ (NZAC); Carterton Dist. Tararua Forest Park, Holdsworth, Loop Trail, 40°53'59.9''S, 175°27'56.5''E, 14–15.iv.2011, N. Scharff & G. Hormiga leg., 338 m ASL, 1♀ (ZMUC) (PHOTOS GH6043–6059, NS3662–3675); Wairoa Dist. Te Urewera Nat. Park, Lake Waikaremoana, trail to Lake Waikareiti, 38°44'32''S, 177°9'53.1''E, 6.iv.2011, N. Scharff & G. Hormiga leg., 650 m ASL, 1♀1juv (ZMUC); AK, Waitakere Ranges Reg. Park, Kauri Grove Trk., 36°57'50.48''S, 174°30'47.7''E, 14.i.2011, A. Schomann & J. Pedersen leg., deciduous forest with Kauri, sifted litter & handpick, 320 m ASL, 1♀ (ZMUC); Moerangi, 38°43'S, 176°43'60''E (\*), 4–9.iv.1980, A. Newton & M. Thayer leg., mixed podocarp forest, 1♂ (AMNH); AK Waitakeres, Sharps Bush, 36°50'23''S, 174°35'47''E (\*), 18.xii.2000–15.i.2001, G. Hall leg., 1♀ (NZAC); Hawkes Bay, Waikaremoana, Panekiri Track, 38°47'31.01''S, 177°5'38.02''E (\*), 13.xii.1946, R.R. Forster leg., 1♂ (OM); Kerr-Taylor Reserve, 36°44'52''S, 174°29'58''E (\*), 29.xii.1998–05.i.1999, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♂ (NZAC, Bag #92170); Pihanga Scenic Reserve, Turangi Saddle above power Scheme, nr Summit, 39°2'57.4''S, 175°47'51.95''E (\*), G.W. Ramsay leg., litter 72/4, 2♂♂ (OM); Mt Moehau, 36°32'18''S, 175°24'29''E (\*), 7.xi.1978, B.M. May leg., 610 m ASL, 1♂1juv (NZAC, Bag #92170); Te Urewera Nat. Park, Lake Waikaremoana, Panekiri Bluffs trail, 38°47'58.6''S, 177°06'43.1''E, 7.iv.2011, G. Hormiga & N. Scharff leg., 740 m ASL, 1♀ (GWU); Te Urewera Nat. Park, Lake Waikaremoana, Panekiri Bluffs trail, S38°47'58.6', 177°06'43.1''E, 7.iv.2011, G. Hormiga & N. Scharff leg., 740 m ASL, 1♂ (GWU); WO Waitomo, 38°14'15''S, 175°2'40''E (\*), 24.v.1983, G. Kuschel leg., decayed wood and litter, 1♂ (NZAC, Bag #92170); Mt Te Aroha, BP, NZ. Tui Mine Area, 37°31'35.024''S, 175°44'41.003''E, 1–19.x.2010,

D.S. Seldon leg., regen forest, pitfall traps, 1♀ (MNZ, Cat. No. AS.002342); Auckland Coromandel Peninsula near Summit, 36°51'31.42''S, 175°29'52.5''E (\*), 19.i.1972, G.W. Ramsay leg., leaf litter, 1♂ (MNZ); Taranaki: Whitecliffs, 38°49'37.93''S, 174°34'59.18''E (\*), 27.xii.1991, Les Stanley leg., 1♂ (MNZ); Taranaki: Awakino Gorge, 38°40'21.37''S, 174°40'50.71''E (\*), 22.i.1972, G.W. Ramsay leg., litter, 1♂ (MNZ); Taranaki: Whitecliffs, 38°49'37.93''S, 174°34'59.18''E (\*), 27.xii.1991, Les Stanley leg., 1♂ (MNZ); Coromandel Peninsula Summit, 36°51'31.42''S, 175°29'52.5''E (\*), 19.i.1972, G.W. Ramsay leg., leaf litter, 1♂ (MNZ); Auckland: Te Tapui Scenic Reserve, 37°48'20.44''S, 175°37'51.93''E (\*), 8.viii.1984, D.J. Court leg., litter, 1♀ (MNZ); Te Kauri Scenic Reserve, 38°4'29.08''S, 174°58'37.89''E (\*), 16.iii.1985, B.J. Moyle leg., 1♂1♀ (OM); Auckland: Te Kauri Scenic Reserve, 38°4'29.08''S, 174°58'37.89''E (\*), 16.iii.1985, B.J. Moyle leg., 1♂1♀ (MNZ); Coromandel Range, CL, NZ. Kauaeranga Valley, Trestle View Camp, 37°3'48.25751''S, 175°40'10.28325''E, 19.x-05.xi.2010, D.S. Seldon leg., pitfall traps, 1♂ (MNZ, Cat. No. AS.002340); Mangaweka, 1983, H.P. McColl leg., 1♀ (NZAC).

*Tingotingo aho* Hormiga & Scharff, sp. nov.

(Fig. 28–31, 57)

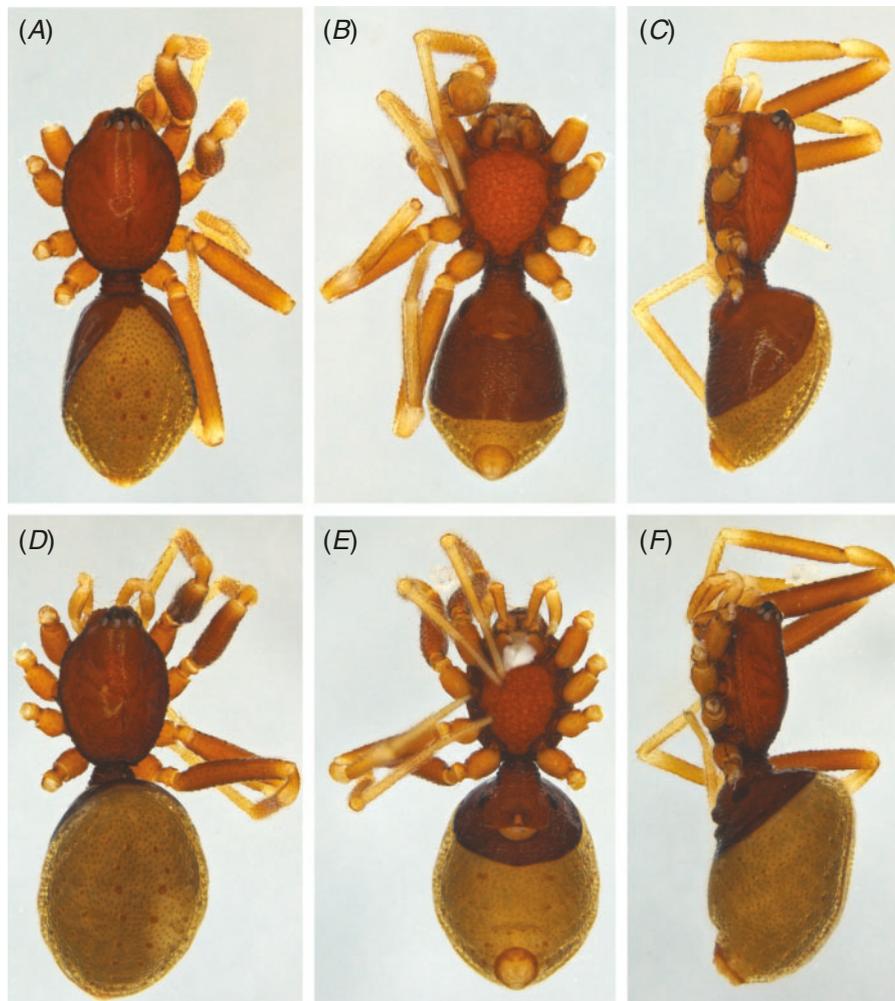
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*Diagnosis*

Males of *Tingotingo aho* are similar to those of *T. pouaru* and uniquely diagnosed by the long and filiform embolus combined with a medially serrated paracymbium apically blunt (Fig. 30B, D) (the paracymbium of *Tingotingo pouaru* has more serrations and a thin and pointed apex). The broad, elliptical epigynal opening of *Tingotingo aho* is diagnostic (Fig. 31A).

*Description*

*Male holotype* (from South Island, Fiordland National Park, Catalogue Number CAS\_ENT\_9035075). Total length 2.59. Cephalothorax 1.13 long, 0.81 wide. Sternum 0.72 long, 0.56 wide, shield-shaped. Abdomen 1.34 long, 0.91 wide. Colour as in Fig. 28A–C (preserved specimen). Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. AME diameter 0.07, all other eyes approximately same diameter. Clypeus height 0.24, 3.4 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 28A, C). Ocular quadrangle same width anteriorly as posteriorly



**Fig. 28.** *Tingotingo aho*, sp. nov. A–C, Male from Cascade Creek. D–F, Female from Cascade Creek. A, Dorsal. B, Ventral. C, Lateral. D, Dorsal. E, Ventral. F, Lateral.

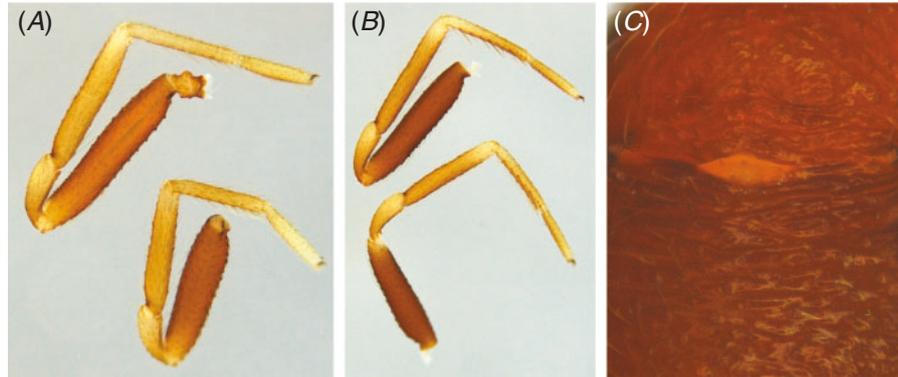


Fig. 29. *Tingotingo aho*, sp. nov., from Cascade Creek. A, C, Male. B, Female. A, B, Legs I (top) and II (bottom), dorsal. C, Male, epigastric fenestra.

(Fig. 28A). Femur I 1.05 long, 0.93 times length of cephalothorax. Patella long, 0.45, 0.40 times length of cephalothorax. Tibia and metatarsi I and II without distinct macrospine pattern. Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.90. Tarsal organ = 0.87. Pedipalp (based on specimen from Mirror Lake, Eglinton Valley) (Fig. 30): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium apically rounded in dorsal view (Fig. 30D). Tarsal organ in 0.82 position along longitudinal cymbial axis (Fig. 30B, D). Paracymbium, short and blunt apically, its medial region serrated (Fig. 30B, D). Embolus long, filiform, completely circling the tegular perimeter (Fig. 30A). Conductor falciform process which is apically pointed and narrow, covering approximately three-quarters of the embolus length. CBA with a small pointed sclerotised process (Fig. 30C).

*Female paratype* (from South Island, Fiordland National Park, Catalogue Number CAS\_ENT\_9035075). Total length 3.24. Cephalothorax 1.26 long, 0.95 wide. Sternum 0.79 long, 0.63 wide. Abdomen 1.84 long, 1.34 wide. Colour as in Fig. 28D–F (preserved specimen). Fovea, longitudinal line (0.21 long), 0.17 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and one (very small) retrolateral teeth. AME diameter 0.08, larger than all other eyes. Clypeus height 0.26, 3.3 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 28D, F). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 28D). Pedipalp with claw, with a longitudinal mesal area with subtle striae. Femur I 1.11 long, 0.88 times length of cephalothorax, not particularly swollen in the middle (Fig. 28F). Patella long, 0.47, 0.37 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 29B). Spine formula: Tbl 5L, Mtl prox-apic (9 spines) 1L1s1L2s1L1s2L; TblII 4L, MtlII (8 spines) 1L1s1L2s1L1s1L. Tarsi I and II not particularly barrel-shaped, short and with almost same thickness throughout length of segment. Trichobothrium metatarsus I = 0.88. Tarsal organ

= 0.88. Epigynum (based on specimen from Mount Burns, west of Monowai) (Fig. 31): epigynal opening elliptical, fully encircled by a highly sclerotised ventral scutum with a caudal fenestra with two subcuticular discs (Fig. 31A). Copulatory funnels anteriorly directed from an unpaired epigynal opening, turning into a descending spiral that connects to the anterior region of globular spermathecae (Fig. 31B). Fertilisation ducts caudally directed.

#### Variation

*Males*: total length 2.56–3.0 ( $n = 4$ ). Cephalothorax length 1.13–1.29 ( $n = 4$ ), cephalothorax width 0.81–0.93 ( $n = 4$ ). *Females*: total length 3.05–3.62 ( $n = 4$ ). Cephalothorax length 1.24–1.48 ( $n = 4$ ), cephalothorax width 0.87–0.95 ( $n = 4$ ).

#### Distribution

New Zealand, South Island. Known only from western part of the island, from Fox Glacier to the southern part of Fiordland National Park (Fig. 57).

#### Natural history

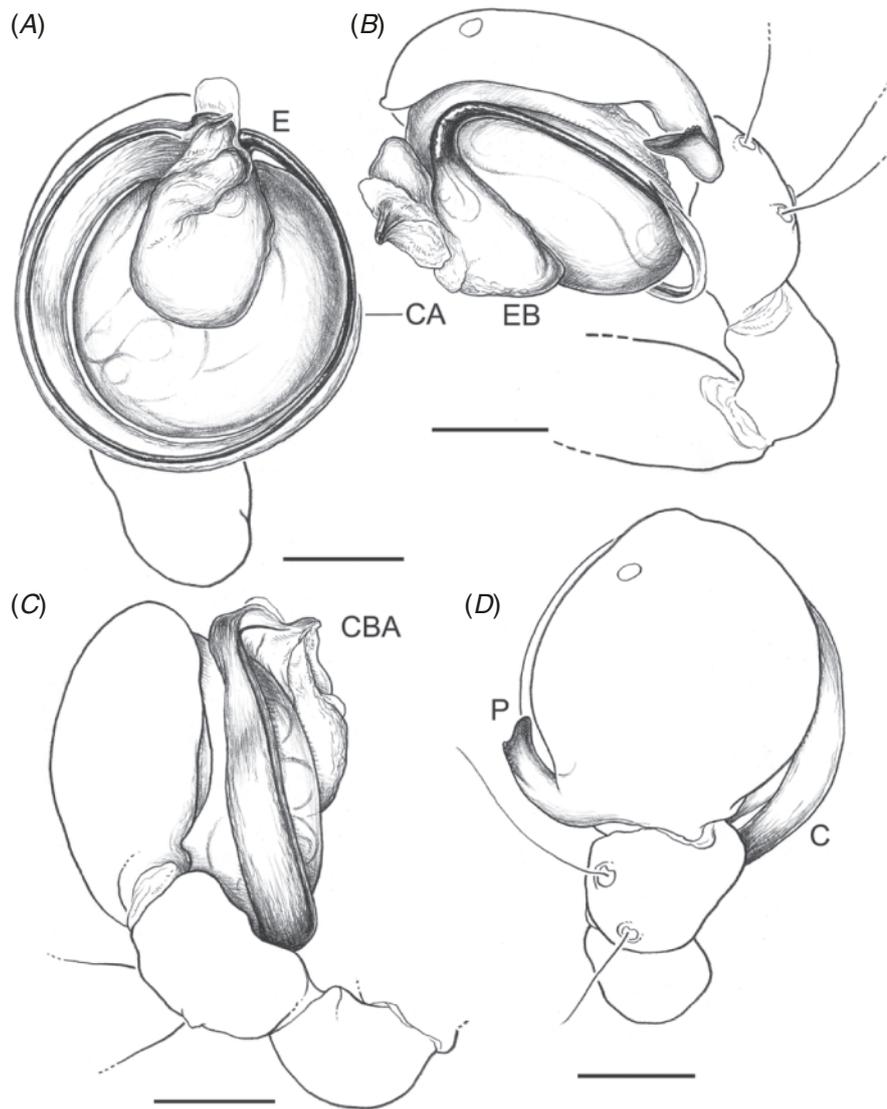
Specimens have been collected in litter, in moss on the forest floor and tree trunks and in pitfall traps in saltwater forests and *Nothofagus* forests. Adult males have been recorded from January–April, July, October and December, adult females from January–April and July. Specimens of *T. aho* have also been collected in pitfall traps in snow tussock grasses (*Chionochloa teretifolia*) in Fiordland, at 1200-m elevation.

#### Etymology

The species epithet is taken from the Māori word *aho* (string, fishing line, cord), in reference to the filiform embolus of this species.

#### Material examined

*Holotype*. New Zealand, South Island, Fiordland National Park, Cascade Creek, 44°53'41"S, 168°4'55"E, 30.vi–01.vii.2008, H. Wood leg., *Nothofagus* forest, sifted litter, 499 m ASL, 1♂ (California Academy of Sciences, Cat. No. CAS\_ENT\_9035075).

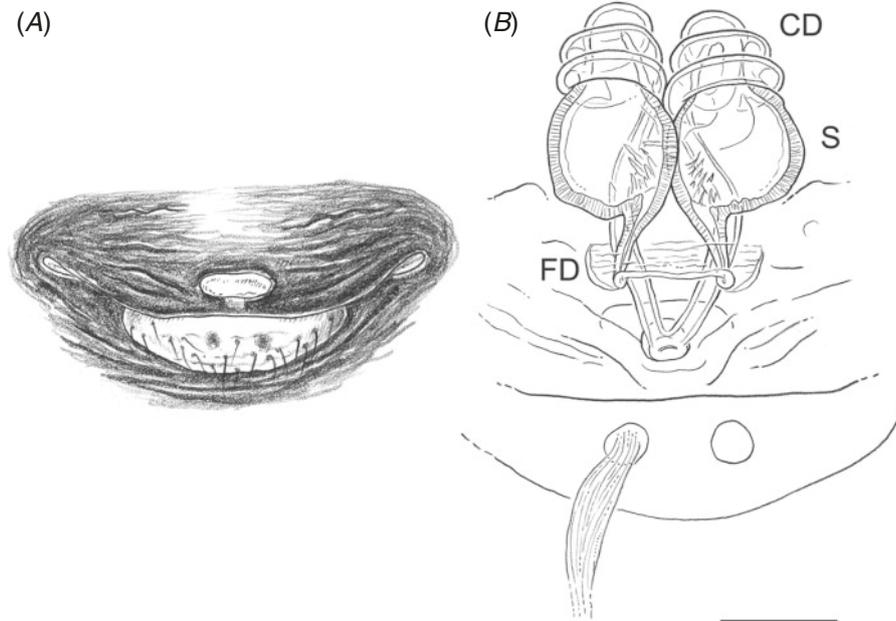


**Fig. 30.** *Tingotingo aho*, sp. nov., male palp, specimen from Eglinton Valley, Mirror Lake, Fiordland. A, Ventral. B, Ectal. C, Mesal. D, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

*Paratype.* Together with holotype male, 1♀ (California Academy of Sciences, Cat. No. CAS\_ENT\_9035075).

*Additional material examined.* South Island, SI, Fiordland Region, Cascade Creek, 44°53'45.91"S, 168°4'50.96"E (\*), 1.xii.1980, R.R. Forster leg., 1♂ (OM); Fiordland, Mirror Lake, Eglinton Valley, 45°1'43.88"S, 168°0'25.9"E (\*), 10.iv.1993, R.R. Forster leg., moss from forest floor, 1♂1♀ (OM); Fiordland, Eglinton Valley Divide, 45°1'43.88"S, 168°0'25.9"E (\*), 12.ii.1987, R.R. Forster leg., moss on tree trunks, 1♂ (OM); Fiordland, Te Anau, 45°25'42.36"S, 167°42'48.9"E (\*), 12–24.i.1954, R. R. Forster leg., moss, 1♂ (OM); Fiordland, Hollyford Valley, Gunn's Camp, 44°45'37.3"S, 168°8'21.84"E (\*), ii.1986, R.R. Forster leg., 1♂ (OM); Fiordlands National Park, Cascade Creek, 44°53'45.91"S, 168°4'50.96"E (\*), 14.i.1971, R.R. Forster leg., pitfall, 1♂ (OM); Fiordland Deep Cove, 45°27'29.0"S, 167°9'1.8"E (\*), 25.i.1958, R.R. Forster leg., from moss on tree trunk at night, 1♀ (OM); Fiordland Deep Cove, 45°27'29.0"S,

167°9'1.8"E (\*), 25.i.1958, R.R. Forster leg., from moss, 1♂ (OM); Fiordland, Hollyford Valley, Gunn's Camp, 44°45'37.3"S, 168°8'21.84"E (\*), ii.1986, R.R. Forster leg., 1♂ (OM); Fiordland, Hollyford Valley, 44°41'9.04"S, 168°8'E2.22" (\*), 27.iii.1987, R.R. Forster leg., moss from forest floor, 1♂ (OM); Fiordland, Mirror Lake, Eglinton Valley, 45°1'43.88"S, 168°0'25.9"E (\*), 10.iv.1993, R.R. Forster leg., moss from forest floor, 1♂ (OM); Fiordland, Cascade Creek, 44°53'45.91"S, 168°4'50.96"E (\*), 6.x.1978, R.R. Forster leg., moss from forest floor, 3♂♂ (OM); Westland, Minnehaha Track, near Fox Glacier, 43°28'5.13"S, 170°1'2.19"E (\*), 18.ii.1984, R.R. Forster leg., moss from forest floor, 1♀ (OM); DF: W slopes of Mt Burns (W of Monowai), 45°44'48"S, 167°23'7"E, 23–28.i.2011, A. Solodovnikov & L. Vilhelmsen leg., beech forest, pitfall traps, 900–950 m ASL, 2♀♀ (ZMUC); DF: W slopes of Mt Burns (W of Monowai), 45°44'48"S, 167°23'7"E, 23–28.i.2011, A. Solodovnikov & L. Vilhelmsen leg., beech forest, pitfall traps, 900–950 m ASL, 1♀



**Fig. 31.** *Tingotingo aho*, sp. nov., epigynum, specimen from the western slopes of Mount Burns. *A*, Ventral (the epigynal opening is the aperture anterior to the fenestra on the abdominal scutum). *B*, Dorsal, cleared. Scale bars: *A*, 0.2 mm; *B*, 0.1 mm. Abbreviations: CD, copulatory duct; FD, fertilisation duct; S, spermatheca.

(ZMUC); DF: W slopes of Mt Burns (W of Monowai), 45°44'54''S, 167°22'55''E, 23–24.i.2011, A. Solodovnikov & L. Vilhelmsen leg., beech forest tree line, sifted leaf litter, 1000–1100 m ASL, 1♀ (ZMUC); Pomona I., L. Manapouri, 45°33'59''S, 167°36'31''E (\*), 30.xi–03.xii.2005, P. Michael & J. MacTavish leg., pitfall, 1♀ (MNZ, Cat. No. AS.001507; Fiordland National Park, Cascade Creek, 44°53'41''S, 168°4'55''E, 30.vi–01.vii.2008, H. Wood leg., *Nothofagus* forest, sifted litter, 499 m ASL, 1♂1♀ (California Academy of Sciences, Cat. No. CAS\_ENT\_9035075); Grant Road, Saltwater Forest, 43°6'41''S, 170°24'12''E (\*), 25.iii.1991, P. Walsh leg., saltwater forest, pitfall, 1♀1juv (California Academy of Sciences, Cat. No. CAS\_ENT\_9032839); Lake Hauroko, 45°59'26''S, 167°23'3''E (\*), 20–30.i.1992, R.R. Forster leg., moss, 1♂ (OM). South Island, Fiordland Takahe Valley, –45.2735475 167.627021, 7.xi.2012–12.iii.2013, R. Leschen, A. Schnurpfeil, *Chionochloa teretifolia*, pitfall trap, 1220 m ASL, 4♂7♀ (NZAC). South Island, Fiordland, Takahe Valley, –45.2735475 167.627021, 9.i.2014–1.iii.2014, A. Brandt, K. Collins, *Chionochloa teretifolia*, pitfall trap, 1220 m ASL, 7♂6♀ (NZAC).

***Whakamoke*** Hormiga & Scharff, gen. nov.

<http://zoobank.org/NomenclaturalActs/FBE3E00C-94DF-4F63-ABFB-FFF309FFB035>

*Type species: Whakamoke orongorongo*, sp. nov.

*Diagnosis*

Males of *Whakamoke* are diagnosed by the apical region of the embolus, which is of irregular shape, often with lobes and undulations, but never filiform as in the species of *Tingotingo* (Fig. 10C, 17C, 42). In *Whakamoke*, the embolus trajectory does not form a complete circle and the spermduct of most species bears a constriction in the tegular region, absent in the

*Tingotingo* species (Fig. 34, 48). In *Whakamoke*, the paracymbium is distally acute, without processes (Fig. 17F, 34A), whereas in *Tingotingo* the paracymbium is either bifurcated (Fig. 20D) or has some kind of distal process (Fig. 30D). Females of *Whakamoke* are diagnosed by the open fenestra on the abdominal scutum, posteriad to the epigynum (Fig. 32E); this opening of the scutum is closed in the *Tingotingo* species (Fig. 18F). The legs of *Whakamoke* species have a long patella, and longer leg segments (tarsi/metatarsus) than those in *Tingotingo* species, and the femur I in both sexes is always longer than the carapace length; in *Tingotingo* the carapace is never shorter than femur I.

*Description*

*Male.* Total length 3.02–5.15, cephalothorax length 1.25–2.36, cephalothorax width 0.96–1.74. Cephalothorax dark brown. Abdomen creamy coloured, except scutum (dark brown), covered with numerous small sclerotised discs, each bearing a seta, of lighter colour than the scutum, with two longitudinal rows of four to six sigilla. Abdomen with a heavily sclerotised scutum covering laterally its anterior half and ventrally extending caudally approximately three-quarters of the abdomen length (Fig. 32). Abdominal scutum projects anteriorly into a heavily sclerotised ring encircling the pedicel. Medial epigastric region exposed through a fenestra in the scutum; booklung covers pigmented in darker brown colour. Spinnerets encircled by a sclerotised ring that bears a narrow tracheal spiracle (Fig. 32). Cephalothorax rectangular in lateral view, without distinction between cephalon and thoracic region, and covered with irregularly shaped alveoli.

Posterior margin of cephalothorax with broad elevated ridge. Fovea a longitudinal line. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (Fig. 9, 15) (some species have a subtle mound adjacent to the most proximal prolateral tooth, between prolateral and retrolateral rows). Labium wider than long, fused to sternum. Sternum shield-shaped, covered with irregularly shaped alveoli, fully encircling coxal bases and reaching carapace margin (pleural membranes not visible), projecting caudally into a fully sclerotised ring around the pedicel (Fig. 32). AME larger than all other eyes. Clypeus 2.70–4.10 times one AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed. Femur I 1.08–1.60 times the length of cephalothorax. Patella long. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 14). Tarsi I and II with a large dorsal tarsal organ distally (Fig. 13E); tarsal organ proximal in III and IV. Tarsi without trichobothria, metatarsi I–IV with one distal trichobothrium. Spinnerets (as per examination of *W. paoka*: Fig. 11): ALS with one major ampullate spigot with a nubbin, approximately nine piriform spigots and approximately six or seven tartipores; PMS with one minor ampullate spigot; PLS with one aciniform spigot. Colulus small, with two setae. Approximately 11 epiandrous fusules arranged along the caudal margin of the epigastric furrow, not clustered (Fig. 11F) (these fusules, if correctly identified, are difficult to differentiate from the surrounding setae on the epiandrous area). Pedipalp (Fig. 10, 16, 17, 34): tibia unmodified, without apophyses with three trichobothria. Cymbium apically blunt in dorsal view, tarsal organ subapical. Paracymbium distally acute, without processes, not bifurcated. Embolus apical region of irregular shape, often with lobes or undulating, but never filiform; embolus trajectory does not form a complete circle around the tegular perimeter. Spermduct diameter with a conspicuous constriction before entering into embolus in most species, best seen in ventral view. Conductor falciform process covering approximately two-thirds of the embolus length, with a basal process (CBA) bearing an apophysis of varying morphology and running in opposite direction to embolus.

*Female.* Total length 3.06–6.02, cephalothorax length 1.26–2.68, cephalothorax width 1.08–2.10. Colour as in male. Cephalothorax rectangular in lateral view, without distinction between cephalon and thorax, and covered with irregularly shaped alveoli. Posterior margin of cephalothorax with broad elevated ridge (Fig. 32D, E). Abdomen with two median longitudinal rows of six or seven sigilla and a heavily sclerotised scutum covering laterally its anterior half or less and ventrally extending caudally to the epigastric margin medially and slightly beyond the booklung spiracles. Abdominal scutum projects anteriorly into a heavily sclerotised ring encircling the pedicel, with an open caudal fenestra (posterior to the epigynum) with one or two subcuticular discs (Fig. 32E). Booklung covers pigmented in darker brown colour. Spinnerets encircled by a sclerotised ring with a narrow tracheal spiracle. Tracheal

system consisting of two pairs of simple trunks restricted to the abdomen, the lateral trunks being shorter than the median ones (checked in *W. heru*, female, from Otago, Leith Saddle, OM). Chelicerae with slight proximal swellings anteriorly (Fig. 15C), with two prolateral and two retrolateral teeth (in some species with a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). Labium wider than long, fused to sternum. Sternum shield-shaped, covered with irregularly shaped alveoli, fully encircling coxal bases and reaching carapace margin (pleural membranes not visible), projected caudally with a fully sclerotised ring around the pedicel. AME larger than all other eyes. Clypeus 2.60–4.50 times one AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed. Femur I 1.13–1.88 times length of cephalothorax. Patella long. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments. Tarsi I and II with a large dorsal tarsal organ distally; tarsal organ proximal in III and IV. Tarsi without trichobothria, metatarsi I–IV with one distal trichobothrium. Pedipalp with claw, with striae along the longitudinal axis in some species (e.g. *W. paoha*: Fig. 13C, F). Spinnerets (as per examination of *W. paoka*: Fig. 11): ALS with one major ampullate spigot with a nubbin, approximately 11 piriform spigots and approximately 8 tartipores; PMS with one cylindrical and one minor ampullate spigot; PLS with two cylindrical spigots and one aciniform spigot adjacent to the distal cylindrical spigot. Colulus, small, with two setae. Epigynal region fully encircled by a highly sclerotised ventral scutum, with two (sometimes one) subcuticular discs posterior to the scutum margin (Fig. 12F, 35). Spermathecae spherical, copulatory ducts run anteriorly (Fig. 35), except in *W. heru*, sp. nov. (Fig. 53B) and *W. rakiura*, sp. nov. (Fig. 56C, D), which have the ducts caudally directed. Fertilisation ducts caudally or ectally directed.

#### Composition

*Whakamoke orongorongo*, sp. nov.; *W. tarakina*, sp. nov.; *W. guacamole*, sp. nov.; *W. hunahuna*, sp. nov.; *W. paoka*, sp. nov.; *W. heru*, sp. nov.; and *W. rakiura*, sp. nov.

#### Phylogenetics

The species *W. orongorongo*, *W. paoka*, and *W. heru* form a highly supported clade in the molecular analyses of Dimitrov *et al.* (2017) (Fig. 4). The sister group of *Whakamoke* is the genus *Tingotingo*.

#### Distribution

New Zealand (North, South and Stewart Islands) (Fig. 58, 59).

#### Etymology

The genus name is derived from the Māori word *whakamoke* (to hide, to ambush, advance stealthily) in reference to the cryptic habits of these spiders. The name is undeclinable and masculine in gender.

***Whakamoke orongorongo*** Hormiga & Scharff, sp. nov.  
(Fig. 32–35, 58)

<http://zoobank.org/NomenclaturalActs/1FD4D08A-CF71-4926-9B55-92A82E273492>

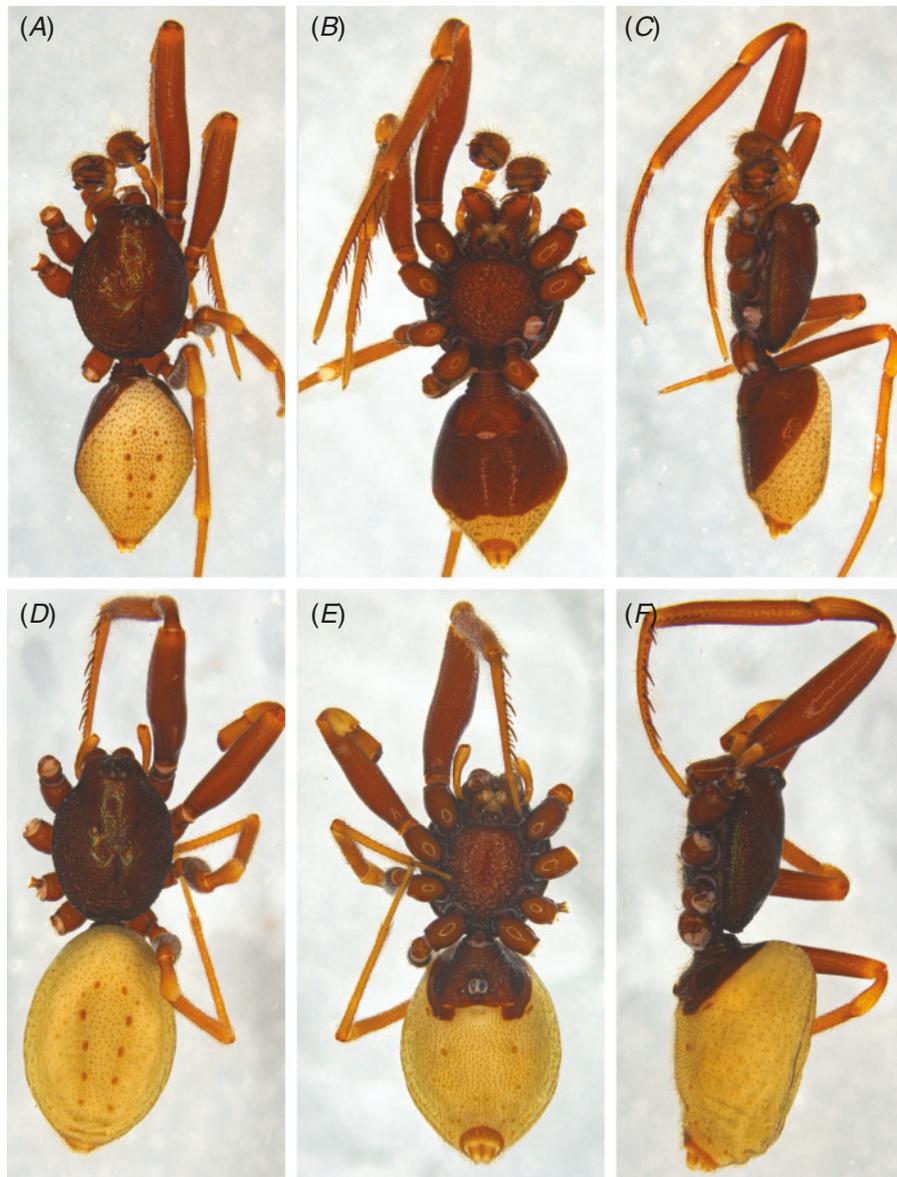
*Diagnosis*

Males of *W. orongorongo* are most similar to those of *W. paoka* and *W. tarakina*, but can be distinguished from them by the shape of the paracymbium (Fig. 34D), which is apically more pointed in the latter two species and more sinuous in *W. tarakina*. The epigynum of *Whakamoke orongorongo* (Fig. 35) is most similar to that of *W. paoka* (Fig. 49), both having two longitudinal slits

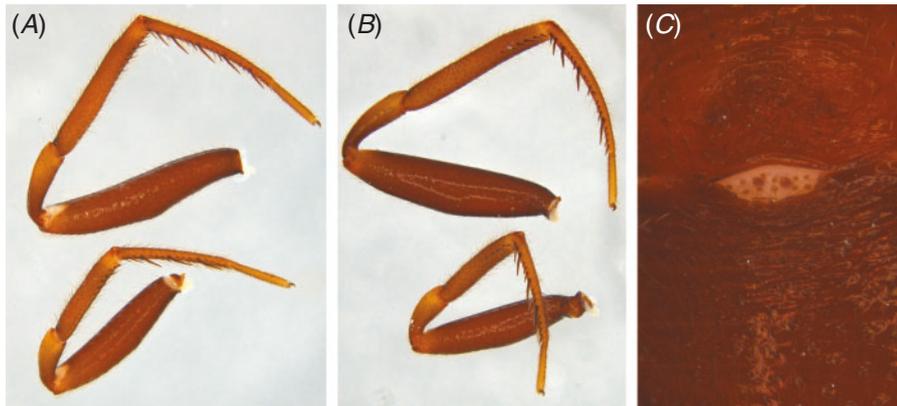
circled by cuticle that is clearly less sclerotised than the rest of the epigynal area, but the slits are narrower in the latter species.

*Description*

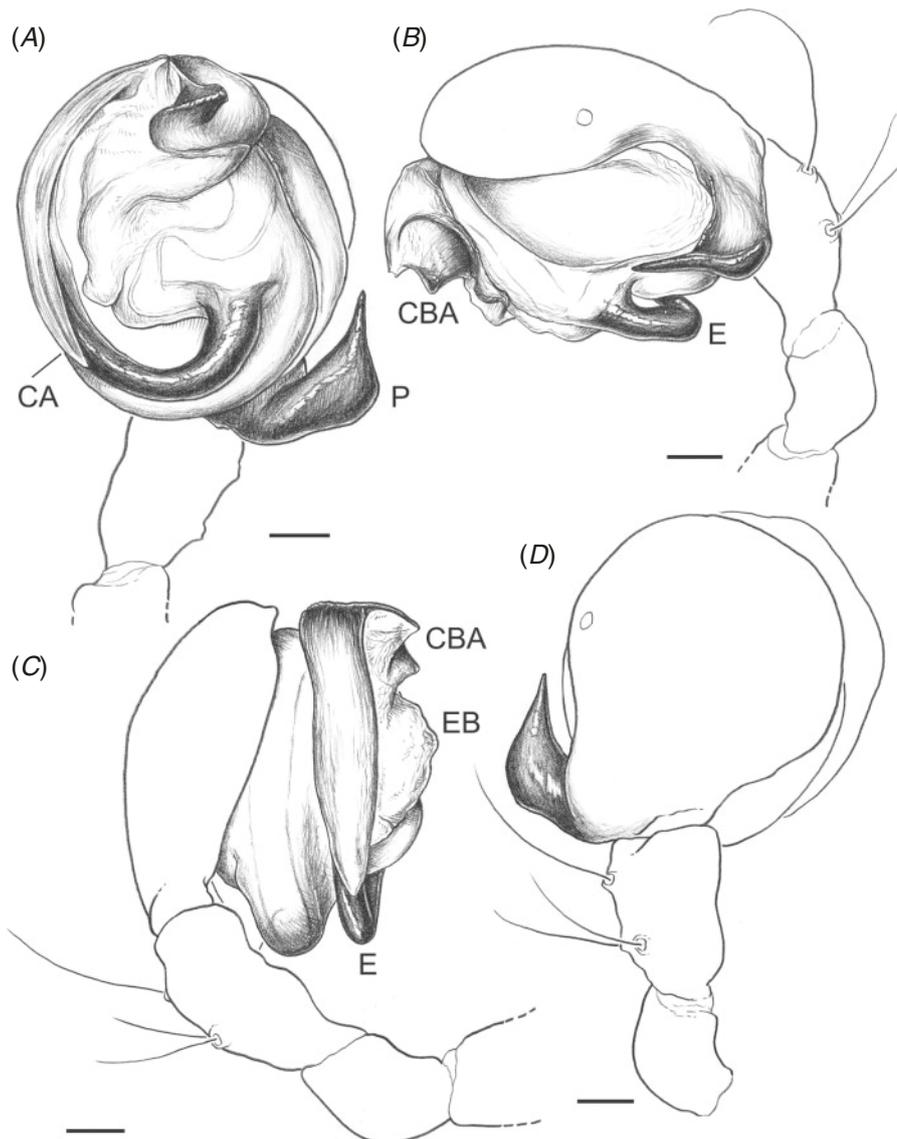
*Male holotype* (from North Island, Orongorongo Valley, MNZ). Total length 5.15. Cephalothorax 2.29 long, 1.80 wide. Sternum 1.59 long, 1.15 wide, shield-shaped. Abdomen 2.72 long, 1.77 wide. Colour as in Fig. 32A–C (preserved specimen). Fovea, longitudinal line (0.52), 0.23 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME



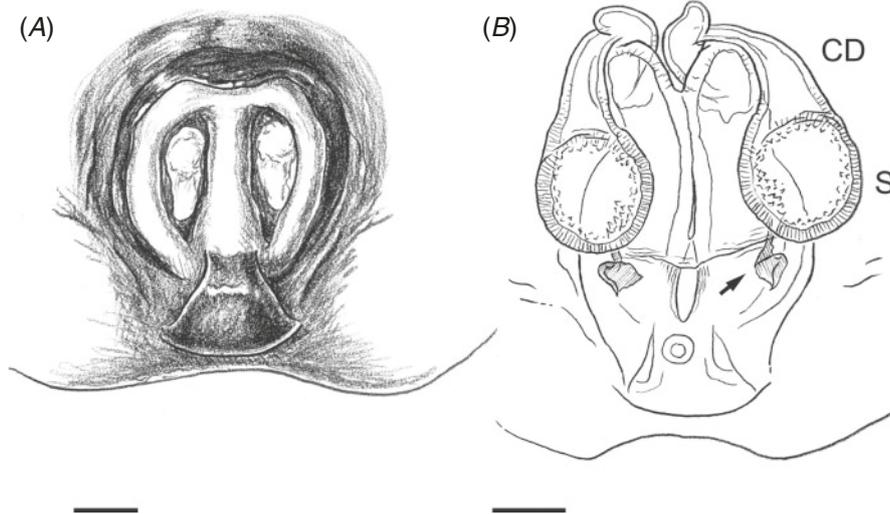
**Fig. 32.** *Whakamoke orongorongo*, sp. nov. A–C, Male from Orongorongo Valley. D, E, Female from Orongorongo Valley. A, Dorsal. B, Ventral. C, Lateral. D, Dorsal. E, Ventral. F, Lateral.



**Fig. 33.** *Whakamoke orongorongo*, sp. nov. *A–C*, Male from Orongorongo Valley. *B*, Female from Orongorongo Valley. *A–B*, Legs I (top) and II (bottom), dorsal. *C*, Male, epigastric fenestra.



**Fig. 34.** *Whakamoke orongorongo*, sp. nov., male palp, specimen from Orongorongo Valley. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.



**Fig. 35.** *Whakamoke orongorongo*, sp. nov., epigynum, specimen from Orongorongo Valley. *A*, Ventral (the caudal knob is the dark triangular structure at the bottom of the illustration). *B*, Dorsal, cleared (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.

diameter 0.17, larger than all other eyes. Clypeus height 0.50, 2.9 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 32*A, C*). Ocular quadrangle same width anteriorly as posteriorly (Fig. 32*A*). Femur I 2.70 long, 1.2 times length of cephalothorax. Patella long, 1.14, 0.50 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 33*A*), spine formula: Tbl 5L, Mtl prox-apic (17 spines) 1s1L2s1L3s1L3s1L4s; TblII 6L, MtlII (14 spines) 1s2L3s1L3s1L4s. Tarsi I and II not particularly barrel-shaped, more or less same thickness throughout its length. Trichobothrium metatarsus I = 0.96. Tarsal organ = 0.85. Pedipalp (Fig. 34): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium apically blunt in dorsal view (Fig. 34*D*). Tarsal organ in 0.72 position along longitudinal cymbial axis (Fig. 34*B*). Paracymbium with a broad base as seen in dorsal view, and apically pointed. Embolus with a large base, apically lamelliform, approximately half a complete circle of the tegular perimeter. Spermduct diameter with a conspicuous constriction before entering into embolus, best seen in ventral view (Fig. 34*A*). Conductor falciform process covering approximately two-thirds of the embolus length. CBA with a pointed sclerotised process, ectally directed in ventral view (Fig. 34*A, C*).

*Female paratype* (from North Island, Orongorongo Valley, MNZ). Total length 5.92. Cephalothorax 2.42 long, 1.95 wide. Sternum 1.63 long, 0.126 wide. Abdomen 3.47 long, 2.39 wide. Colour as in Fig. 32*D–F* (preserved specimen). Fovea, longitudinal line (0.57 long), 0.40 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth

(a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.14, larger than other eyes. Clypeus height 0.45, 3.2 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 32*D, F*). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 32*D, F*). Pedipalp with claw, unmodified. Femur I 2.90 long, 1.2 times length of cephalothorax, swollen in the middle (Fig. 32*F*). Patella long, 1.27, 0.53 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 33*B*). Tbl 6(7)L, Mtl prox-apic (19–20 spines) 1s2L3s1L3s1L4s (1s1L1s1L3s1L3s1L4s on right leg); TblII 6L, MtlII (15 spines) 1s2L3s1L3s1L4s. Tarsi I and II not particularly barrel-shaped, long and with almost same thickness throughout length of segment. Trichobothrium metatarsus I = 0.96. Tarsal organ = 0.85. Epigynum (Paratype) (Fig. 35*A, B*): epigynal region longer than wide, fully encircled by a highly sclerotised ventral scutum with a sclerotised caudal triangular knob, with two subcuticular discs posterior to the scutum margin. Central epigynal area distinctly less sclerotised and semimembranous, divided into three longitudinal lobes by two deep incisions, the medial lobe being only slightly wider than the lateral lobes and continuous with the caudal knob (Fig. 35*A*). Copulatory ducts run longitudinally from copulatory openings, turn medially to then loop dorsally (with a small caecum at the turning point), and descend into more or less globular spermathecae. Fertilisation ducts caudally directed (Fig. 35*B*).

#### Variation

*Males*: total length 4.87–5.15 ( $n = 3$ ). Cephalothorax length 2.29–2.35 ( $n = 3$ ), cephalothorax width 1.74–1.80 ( $n = 3$ ).

*Females*: total length 5.86–6.02 ( $n = 4$ ). Cephalothorax length 2.42–2.68 ( $n = 4$ ), cephalothorax width 1.88–2.10 ( $n = 4$ ).

#### Distribution

New Zealand, North Island. Known only from the Wellington District in the southernmost part of the North Island (Fig. 58).

#### Natural history

Specimens have mainly been collected with pitfall traps, but some specimens have been sifted from the leaf litter or extracted with Berlese funnels. Habitats include *Nothofagus* forest, podocarp broadleaf forest, and hardwood forests. Adult males recorded during February–August and in December. Adult females from February–April, June and in November.

#### Etymology

The species epithet is a name taken in apposition from the type locality, the Orongorongo Valley.

#### Material examined

*Holotype*. New Zealand, North Island, Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 16.iii.1992, pitfall 6, 1♂, B.M. Fitzgerald leg. (MNZ).

*Paratype*. New Zealand, North Island, Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 16.xi.1992, pitfall 6, 1♀, B.M. Fitzgerald leg. (MNZ).

*Additional material examined*. North Island, HB, Kaweka Range, Makahu Hut, 39°17'19"S, 176°23'55"E (\*), 13.iii.1980, C.F. Butcher leg., litter, 975 m ASL, 1♀, NZAC, Cat. No. Bag #92170; Kaitoka Regional Park, WN, NZ, 41°0'25"S, 175°11'01"E (\*), 28.ii–7.iii.2011, R. Barbieri leg., pitfall trap, 1♀ (MNZ, Cat. No. AS.002373); Kaitoka Regional Park, WN, NZ, 41°0'25"S, 175°11'01"E (\*), 10.iii–17.iii.2011, R. Barbieri leg., pitfall trap, 1♂ (MNZ, Cat. No. AS.002374); Wellington, Stokes Valley, 41°10'47.73"S, 174°59'18.17"E (\*), 30.xi.1947, R.R. Forster leg., leaf litter, 1♀ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 14.ii.1992, R.R. Forster leg., pit 10 OUFs, 1♂ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 1.iv.1993, R.R. Forster leg., pit 3 Orongorongo, 1♀ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 1.vi.1992, R.R. Forster leg., pit 7 OUFs, 1♂ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 15.v.1992, R.R. Forster leg., pit 5 OUFs, 1♂ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 15.vii.1992, R.R. Forster leg., pit 10 OUFs, 1♂ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 1.viii.1993, R.R. Forster leg., pit 2 Orongorongo, 1♂ (QM); Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), 16.iii.1992, R.R. Forster leg., pit 2 OUFs, 1♂ (QM); Wellington, Days Bay, 41°16'54.25"S, 174°54'47.18"E (\*), 2.vi.1942, R.R. Forster leg., under logs, 1♀ (QM); Wellington, Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1.ii.1976, R.R. Forster leg., broadleaf forest, pitfall Ecol. Divn., 1♂ (QM); Wellington, Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), viii.1975, R.R. Forster leg., broadleaf forest, pitfall Ecol. Divn., 1♂ (QM); Wellington, Stokes Valley, 41°10'47.73"S, 174°59'18.17"E (\*), 10.xi.1948, R.R. Forster leg., leaf litter, 1♀ (QM); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 2.ii.1994, P. Berben & J. Alley leg., silver beech, pitfall 6, 1♀ (MNZ); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 1.iii.1996, P. Berben & J. Alley leg., silver beech, pitfall 6, 1♂ (MNZ, Cat. No. AS.001508); Opepe Res., 16.5 km SE Taupo, 38°46'2"S, 176°13'2"E (\*), 5–8.iv.1980, A. Newton & M. Thayer leg., podocarp–broadleaf, berlese, forest litter, 680 m ASL, 1♂ (AMNH); Kapiti Island, Kanuka forest, Kaiwharawhara catchment, 40°52'S,

174°54'E (\*), iv–v.1995, pitfall trp3, 2♂♂ (MNZ, Cat. No. AS.002347); Atiwhakatu Valley, 40°49'36"S, 175°23'46"E (\*), 7–22.xii.1973, C.L. Wilton leg., 1♂ (MNZ, Cat. No. AS.001499); Orongorongo Valley, 41°24'17"S, 174°55'01"E (\*), 16.iii.1995, P. Berben & J. Alley leg., silver beech, pitfall trap, 1♂ (MNZ, Cat. No. AS.002339); Akatarawa Saddle, 41°4'44"S, 175°6'29"E (\*), 11–18.v.1999, P.H. Berben leg., hardwood forest, pitfall, 400–540 m ASL, 1♂ (MNZ, Cat. No. AS.001522); C.L. Pemberton Scenic Bush, 39°52'46"S, 175°54'46"E (\*), iii.2003, 1♀ (MNZ, Cat. No. AS.002348).

#### *Whakamoke tarakina* Hormiga & Scharff, sp. nov.

(Fig. 36–39, 58)

<http://zoobank.org/NomenclaturalActs/27E2E6DD-8854-42F7-BFAF-5FB3606A02AE>

#### Diagnosis

Males of *W. tarakina* are most similar to those of *W. orongorongo* and *W. paoka*, all of which share an overall palpal morphology and a spermduct diameter with a conspicuous constriction before entering into the embolus (best seen in ventral view: Fig. 38A). These three species can be distinguished by differences in the paracymbium shape, particularly in dorsal view (Fig. 38D) and by the multilobate embolus in *W. tarakina* (such embolar projections are absent in *W. orongorongo* and *W. paoka*). In ventral view, females of *W. tarakina* can be distinguished from all other species in the genus by the uniquely cordiform epigynal shape (Fig. 39A), having two circular openings separated by a longitudinal septum with a U-shaped caudal epigynal lip (Fig. 39B).

#### Description

*Male holotype* (from North Island, Atuanui, Mount Auckland, AWMM Catalogue Number AMNZ60750). Total length 4.25. Cephalothorax 1.97 long, 1.51 wide. Sternum 1.36 long, 0.94 wide, shield-shaped. Abdomen 2.26 long, 1.53 wide. Colour as in Fig. 36A–C (preserved specimen). Fovea, longitudinal line (0.40), almost one fifth of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.11, all other eyes approximately same diameter. Clypeus height 0.40, 3.6 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 36A, C). Ocular quadrangle same width anteriorly as posteriorly (Fig. 36A). Femur I 2.49 long, 1.26 times length of cephalothorax. Patella I 1.04 long, 0.53 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 37A), spination less pronounced in males, compared with females; the following spine formula is taken directly from the male leg photo: TBI 6L, Mti prox-apic (19 spines) 2s1L3s1L3s1L3s1L4s; TBI 6L, Mti (15 spines) 2s1L3s1L3s1L4s. Tarsi I and II not particularly barrel-shaped, long and with almost same thickness throughout length of segment. Trichobothrium metatarsus I = 0.97.

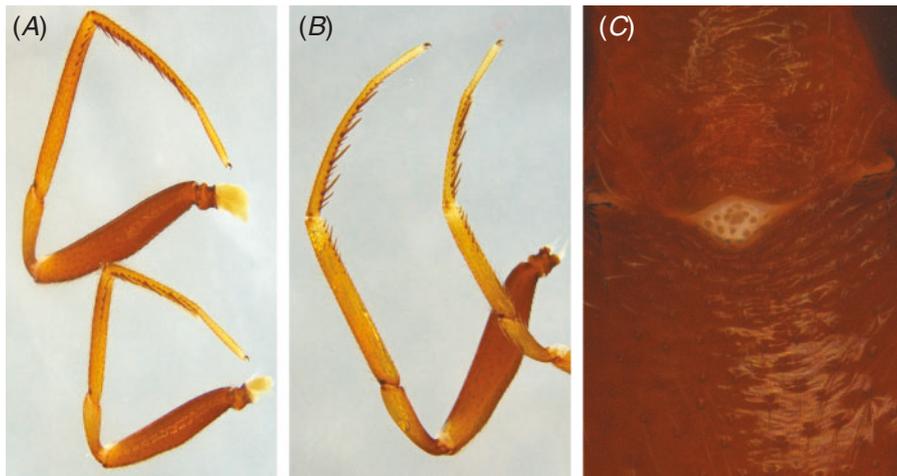


**Fig. 36.** *Whakamoke tarakina*, sp. nov., from Atuanui, Mount Auckland. *A–C*, Male. *D–F*, Female. *A*, Dorsal. *B*, Ventral. *C*, Lateral. *D*, Dorsal. *E*, Ventral. *F*, Lateral.

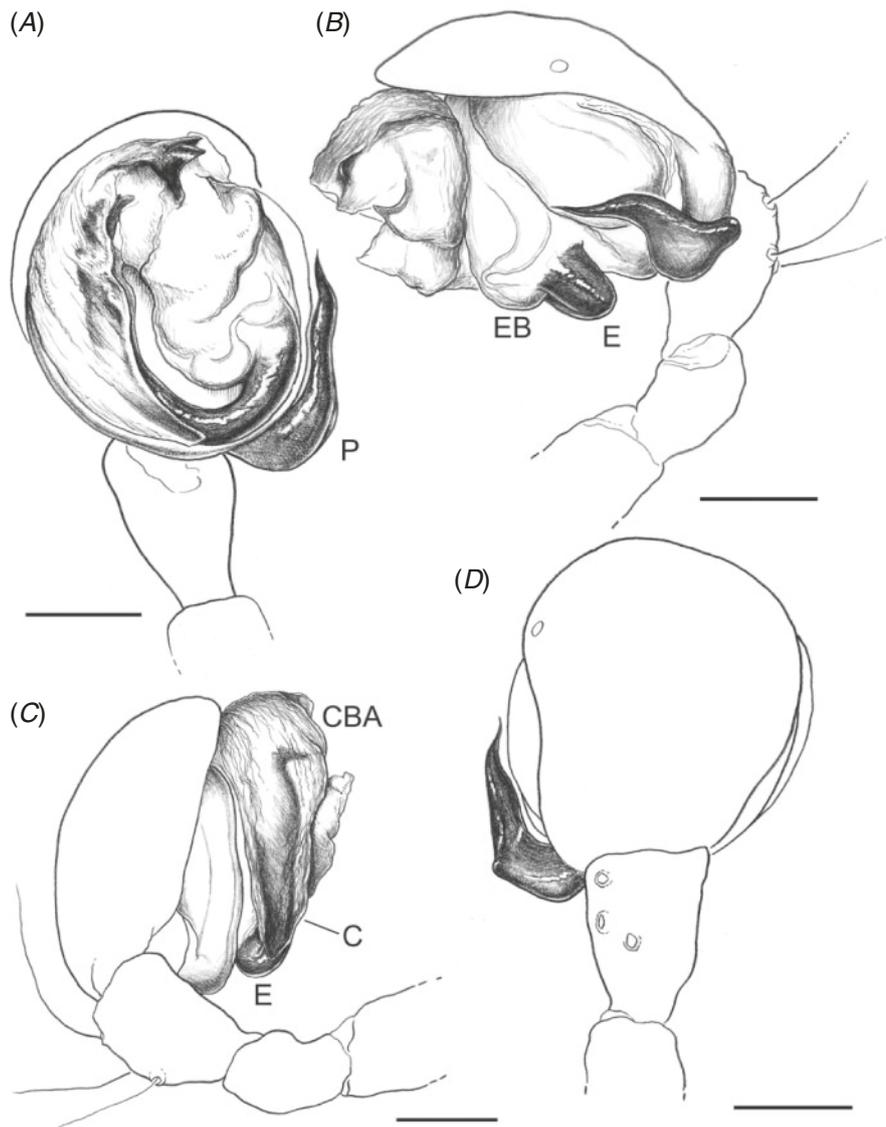
Tarsal organ = 0.83. Pedipalp (North Island, Mataitai Forest, AWMM Catalogue Number AMNZ66140) (Fig. 38): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view longer than wide, lacking projections or apophyses, blunt apically (Fig. 38*D*). Tarsal organ in 0.55 position along longitudinal cymbial axis (Fig. 38*B*). Paracymbium with a broad base, sinuous, tapering apically to a thin point, with posterior concave margin in ectal view and a basal projection (best seen in dorsal view). Embolus widest at the base, in ventral view circling approximately half the tegular margin, distal half with conspicuous lobes and processes, apex resting close to the conductor basal apophyses (Fig. 38*A*). Conductor falciform process covering slightly less than three-quarters of the

embolus length (Fig. 38*A, C*). Spermduct diameter with a constriction before entering into embolus. CBA process distally forked.

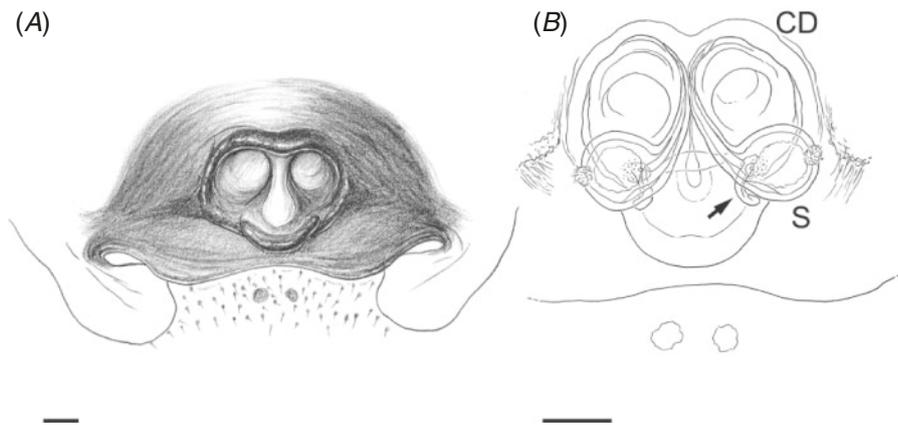
*Female paratype* (from North Island, Atuanui, Mount Auckland, Catalogue Number AMNZ60896). Total length 4.79. Cephalothorax 2.10 long, 1.55 wide. Sternum 1.55 long, 1.14 wide. Abdomen 2.80 long, 1.56 wide. Colour as in Fig. 36*D–F* (preserved specimen). Fovea, longitudinal line (0.40 long), almost one-eighth of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.11, all eyes of equal size. Clypeus height 0.41, 3.72 times AME diameter. All eyes close to



**Fig. 37.** *Whakamoke tarakina*, sp. nov., from Atuanui, Mount Auckland. *A, C*, Male. *B*, Female. *A, B*, Legs I (top) and II (bottom), dorsal. *C*, Male, epigastric fenestra.



**Fig. 38.** *Whakamoke tarakina*, sp. nov., male palp, specimen from Mataitai Forest. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.



**Fig. 39.** *Whakamoke tarakina*, sp. nov., epigynum, specimen from Manawatu, Vinegar Hill Reserve. *A*, Ventral. *B*, Dorsal, cleared (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.

each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 36*D, F*). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 36*D*). Pedipalp with claw, unmodified. Femur I 2.78 long, 1.32 times length of cephalothorax, swollen in the middle (Fig. 36*F*). Patella long, 1.26, 1.67 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 37*B*); the following spine formula is taken directly from the female leg photo: Tbl 6L, Mtl prox-apic 2s1L3s1L3s1L3s1L4s; TblII 6L, MtlII 2s1L3s1L3s1L4s. Tarsi I and II not particularly barrel-shaped, long and with almost same thickness throughout length of segment. Tarsal organ I = 0.87. Trichobothrium metatarsus I = 0.96. Epigynum (Manawatu, Vinegar Hill, OM: Fig. 39); epigynal region cordiform, fully encircled by a highly sclerotised ventral scutum with a sclerotised U-shaped lip along the caudal margin (Fig. 39*A*). A longitudinal median septum extends into caudal epigynal lip. CD long, circling anteriorly around globular spermathecae. FD caudally directed, connecting to spermathecae in the area where the CD connects (Fig. 39*B*).

#### Variation

*Males*: total length 4.25–4.55 ( $n = 4$ ). Cephalothorax length 1.86–2.36 ( $n = 4$ ), cephalothorax width 1.50–1.58 ( $n = 4$ ). *Females*: total length 4.79–5.62 ( $n = 4$ ). Cephalothorax length 2.10–2.36 ( $n = 4$ ), cephalothorax width 1.53–1.79 ( $n = 4$ ).

#### Distribution

New Zealand, North Island. Relatively widespread with records from northern, eastern and southern part of the island (Fig. 58).

#### Natural history

Specimens have been collected in litter, under logs and in pitfall traps in mixed podocarp forest and in kauri (*Agathis australis*) forests. Adult males recorded in January–April and in October–December. Adult females from January, April, September and November–December.

#### Etymology

The species epithet is taken from the Māori word for bristle, spine (*tarakina*), in reference to the characteristic leg macrosetae of these spiders.

#### Material examined

*Holotype*. New Zealand, North Island, Atuanui, Mt Auckland, 36°27'S, 174°28'E (\*), ii.2002, A. Warren leg., pitfall F15, 1♂ (AWMM; Cat. No. AMNZ60750).

*Paratype*. New Zealand, North Island, Atuanui, Mt Auckland, 36°27'S, 174°28'E (\*), iv.2002, A. Warren leg., pitfall E15, 1♀ (AWMM; Cat. No. AMNZ60896);

*Additional material examined*. North Island: C.L. Pemberton, Scenic Bush, 39°52'46"S, 175°54'46"E (\*), iii.2003, 1♂ (MNZ; Cat. No. AS.002348); Hawkes Bay, Dannevirke, 40°12'S, 176°6'E (\*), 12.iv.1943, R.R. Forster leg., 1♀ (OM); Hawkes Bay, Waikaremoana, 38°46'14.25"S, 177°8'8.77"E (\*), 13.xii.1946, R.R. Forster leg., under log, 1♀ (OM); Hawkes Bay, Waikaremoana, Panekiri Track, 38°47'31.01"S, 177°5'38.02"E (\*), 13.xii.1946, R.R. Forster leg., 3♀♀ (one without epigynum) (OM); Hawkes Bay, Waikaremoana, Panekiri Track, 38°47'31.01"S, 177°5'38.02"E (\*), 13.xii.1946, R.R. Forster leg., 1♂ (OM); Ureweras nr Aniwanuiwa Str., 38°44'25.38"S, 177°10'37.78"E (\*), 26.i.1999, C.J. Vink leg., under log, 1♂, (MNZ); AK, Cascades Kauri Park Waitakere Ra., 36°52'45.32"S, 174°31'28.06"E (\*), 14–17.x.1976, J.C. Watt leg., pitfall traps, 1♂ (OM); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall trap C11, 1♂ (AWMM; Cat. No. AMNZ66137); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), iii.2002, A. Warren leg., pitfall trap E1, 1♂ (AWMM; Cat. No. AMNZ66135); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall trap E5, 1♂ (AWMM; Cat. No. AMNZ60748); Great Barrier I, Little Windy Hill, 36°10'S, 175°23'E (\*), 26.viii–18.ix.2003, K. Parsons leg., pitfall trap, 190 m ASL, 1♀ (AWMM; Cat. No. AMNZ62079); Great Barrier I, Te Papanui, 36°10'S, 175°23'E (\*), i.2002, A. Warren leg., pitfall trap C11, 1♂ (AWMM; Cat. No. AMNZ66127); Lake Waikaremoana, Te Piripiri Bay, 38°44'47"S, 177°8'19"E (\*), 22.xi.1996, G. Blackwell leg., pitfall trap, 1♀ (MNZ; Cat. No. AS.001494); Moerangi, 38°43'S, 176°43'60"E (\*), 4–9.iv.1980, A. Newton & M. Thayer leg., mixed podocarp forest, 650 m ASL, 1♀ (AMNH); ND, Pukenui F., 34°48'48.25"S, 173°6'50.45"E (\*), 14.ix.1998, G. Hall leg., rotten logs, 1♀ (NZAC); Coromandel Range, CL, Tapu/Coroglen Tk, 36°59'22.171"S, 175°35'20.296"E, 16.xi–22.xii.2010, D.S. Seldon leg., pitfall traps, 1♂ (MNZ; Cat. No. AS.002343);

Manawatu, Vinegar Hill Reserve, 39°56'5.77"S, 175°38'30.19"E (\*), 12.xii.1948, R.R. Forster leg., under log, 4♀ (OM); Daylate Cave, Whaka Station, Wairoa, MNZ 260, 39°13'59"S, 176°40'00"E (\*), C. McGuinness & M. Hunt, 1♂ (MNZ; Cat. No. AS.001497); Taupo District East of Whenuakau Plain, 38°41'10.23"S, 176°3'36.13"E (\*), 24.i.1960, R.R. Forster leg., 1♂, 1♀ (OM); Atuanui, Mt Auckland, 36°27'S, 174°28'E (\*), iv.2002, A. Warren leg., pitfall trap E13, 1♀ (AWMM; Cat. No. AMNZ66133); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), i.2002, A. Warren leg., pitfall trap D15, 1♂ (AWMM; Cat. No. AMNZ61125); Atuanui, Mt Auckland, 36°27'S, 174°28'E (\*), ii.2002, A. Warren leg., pitfall trap D15, 1♂ (AWMM; Cat. No. AMNZ60897); Atuanui, Mt Auckland, 36°27'S, 174°28'E (\*), iv.2002, A. Warren leg., pitfall trap E5, 1♂ (AWMM; Cat. No. AMNZ66134); Hawkes Bay, Boundary stream, 39°06.08'S, 176°47.85'E, xii.1998–i.1999, pitfall trap, Department of Conservation, 2♀ (CMNZ); Hawkes Bay, Boundary stream, 39°0.83'S,

176°49.68'E, xii.1998–i.1999, pitfall trap, Department of Conservation, 1♀ (CMNZ Museum).

***Whakamoke guacamole*** Hormiga & Scharff, sp. nov.

(Fig. 40–43, 58)

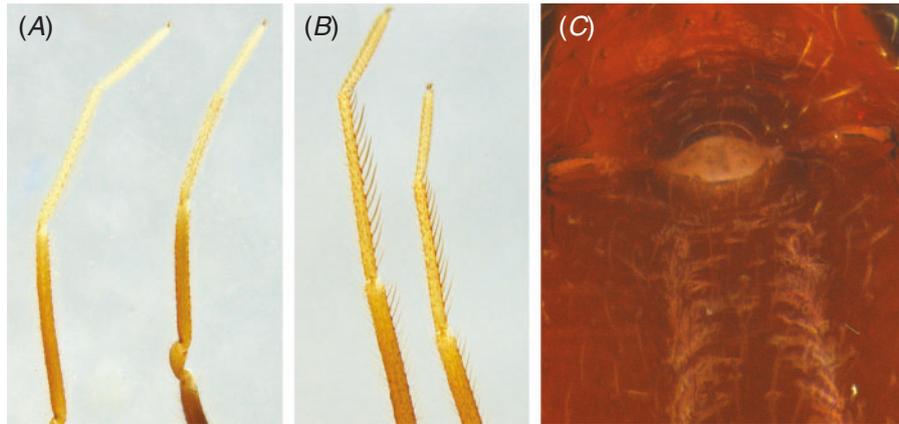
<http://zoobank.org/NomenclaturalActs/DCAF9373-8C20-4ED8-A3A2-15A0083BBA8E>

*Diagnosis*

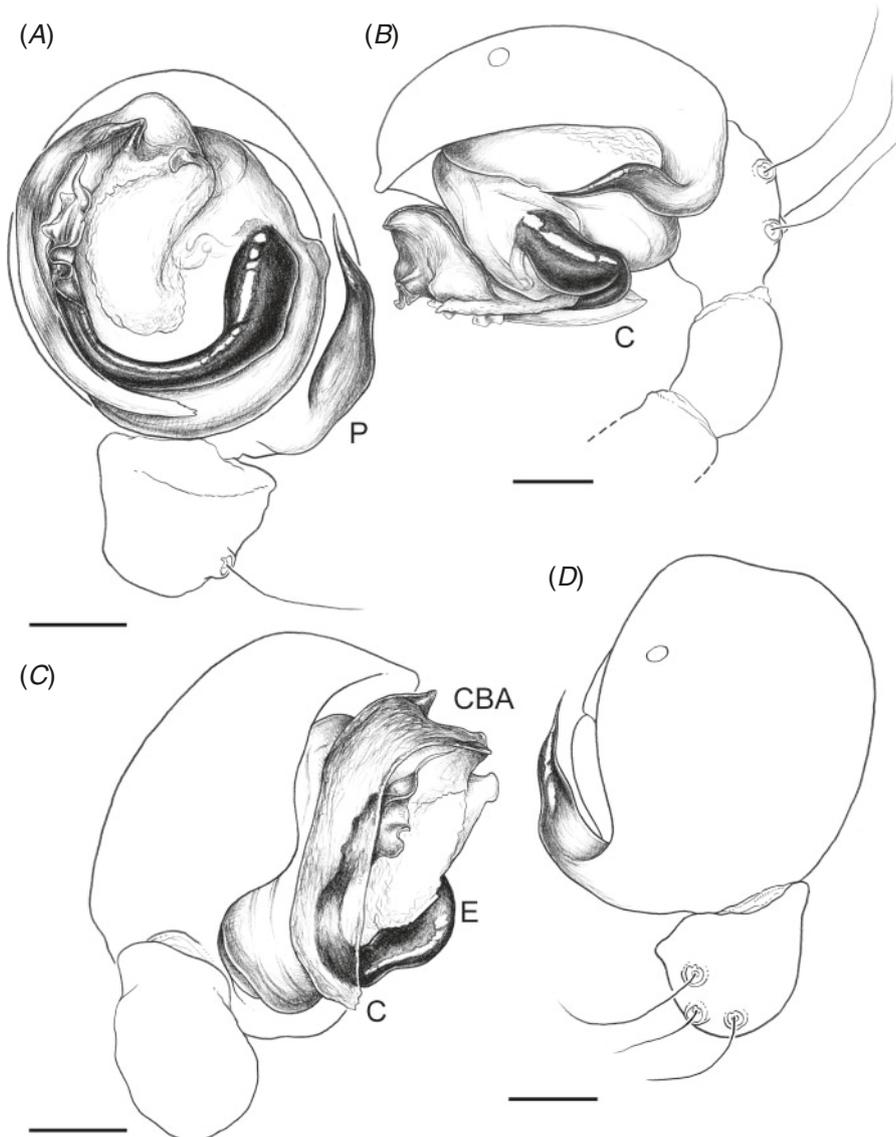
Males of *W. guacamole* are most similar to those of *W. tarakina* and *W. heru*, but are distinguished by their unique embolus morphology, with a distinctively large base and undulate



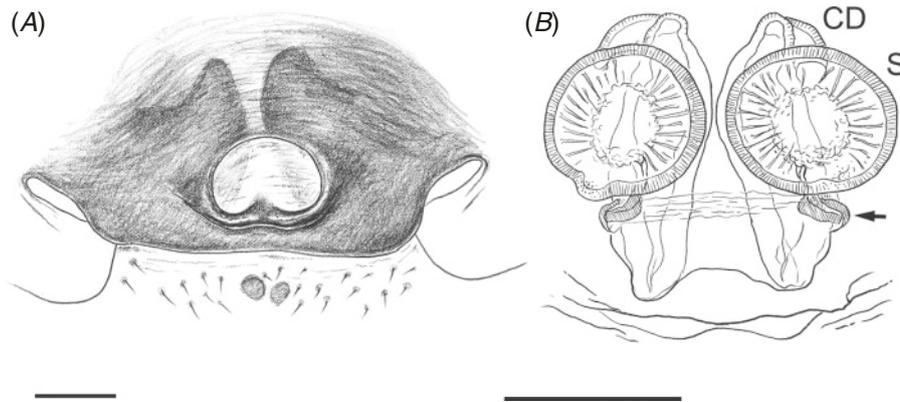
**Fig. 40.** *Whakamoke guacamole*, sp. nov., from Mataitai Forest. A–C, Male. D–F, Female. A, Dorsal. B, Ventral. C, Lateral. D, Dorsal. E, Ventral. F, Lateral.



**Fig. 41.** *Whakamoke guacamole*, sp. nov., from Mataitai Forest. *A, C*, Male. *B*, Female. *A, B*, Legs I (left) and II (right), dorsal. *C*, Male, epigastric fenestra.



**Fig. 42.** *Whakamoke guacamole*, sp. nov., male palp, specimen from Atuanui, Mount Auckland. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.



**Fig. 43.** *Whakamoke guacamole*, sp. nov., epigynum, specimen from Mataitai Forest. *A*, Ventral. *B*, Dorsal, cleared (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.

apical third (Fig. 42*A, C*). Females are diagnosed by their circular epigynal opening lacking a medial septum (Fig. 43*A*); a septum is present in both *W. tarakina* and *W. heru*.

#### Description

*Male holotype* (from North Island, Mataitai Forest S.A., Catalogue Number AMNZ66140). Total length 3.06. Cephalothorax 1.26 long, 0.99 wide. Sternum 0.87 long, 0.71 wide, shield-shaped. Abdomen 1.72 long, 1.00 wide. Colour as in Fig. 40*A–C* (preserved specimen). Fovea not well pronounced, a longitudinal line (0.22 long), 0.18 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly with two prolateral and two retrolateral teeth (a very subtle mound is likely adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows, but this needs to be confirmed with SEM). AME diameter 0.12, larger than all other eyes. Clypeus height 0.33, 2.8 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 40*A, C*). Ocular quadrangle same width anteriorly as posteriorly (Fig. 40*A*). Femur I 2.02 long, 1.60 times length of cephalothorax. Patella long, 0.58, 0.46 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. In males of this species it is not possible to differentiate macrosetae on metatarsi I and II (Fig. 41*A*). Tarsi I and II not particularly barrel-shaped. More or less same thickness throughout the length of tarsus. Trichobothrium metatarsus I = 0.90. Tarsal organ I = 0.88. Pedipalp (Atuanui, Mount Auckland; Fig. 42): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium apically blunt in dorsal view (Fig. 42*D*). Tarsal organ in 0.76 position along longitudinal cymbial axis (Fig. 42*B, D*). Paracymbium sinuous, apically thin and pointed. Embolus with a distinctly enlarged base, lamelliform and undulate for most of the apical third, ending in a thin, sinuous point, approximately three-quarters a complete circle of the tegular perimeter (Fig. 42*A*). Conductor a falciform process

covering approximately two-thirds of the embolus length. CBA with an anteriorly pointed sclerotised process (Fig. 42*C*). A dark subcuticular spot can be seen on both sides of the fenestra, on the scutum, which are apodemes.

*Female paratype* (from North Island, Mataitai Forest S.A., AWMM Catalogue Number AMNZ61124). Total length 3.48. Cephalothorax 1.39 long, 1.11 wide. Sternum 0.90 long, 0.0.76 wide. Abdomen 1.99 long, 1.32 wide. Colour as in Fig. 40*D–F* (preserved specimen). Fovea, longitudinal line (0.30 long), 0.22 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.13, larger than other eyes. Clypeus height 0.34, 2.6 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 40*D, F*). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 40*D*). Pedipalp with claw, tarsus with a ventral area along the full length of the segment lacking setae with many small transversal ridges. Femur I 2.03 long, 1.46 times length of cephalothorax, slightly swollen in the middle. Patella long, 0.62, 0.31 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 41*B*). Spine formula: Tbl 3L, Mtl prox-apic 17 spines of almost equal length (it is hard to differentiate between small and large); TblII 2 or 3L, MtlII 13 spines of almost equal length. Tarsi I and II slightly barrel-shaped, thicker in the middle than at the ends. Trichobothrium metatarsus I = 0.94. Tarsal organ = 0.87. Epigynum (paratype female, Mataitai Forest; Fig. 43): epigynal region fully encircled by a highly sclerotised ventral scutum with two subcuticular discs posterior to its margin (Fig. 43*E*). Central epigynal area has a circular opening with a subtle indentation of its posterior margin (Fig. 43*A*). Copulatory ducts run longitudinally from copulatory openings, turning dorsally into globular spermathecae with a spiculate internal

surface (more so caudally) (Fig. 43B). Fertilisation ducts caudally directed. A dark subcuticular spot can be seen on both sides of the epigynum, which are apodemes.

#### Variation

*Males*: total length 3.06 ( $n = 1$ ). Cephalothorax length 1.25–1.41 ( $n = 4$ ), cephalothorax width 0.96–1.13 ( $n = 4$ ). *Females*: total length 3.06–4.15 ( $n = 4$ ). Cephalothorax length 1.26–1.54 ( $n = 5$ ), cephalothorax width 1.08–1.24 ( $n = 5$ ).

#### Distribution

New Zealand, North Island. Widespread in suitable habitats, recorded mainly in the northern part of the North Island (Fig. 58).

#### Natural history

Specimens of *W. guacamole* have mainly been collected with pitfall traps, but several specimens have also been taken in Malaise traps and flight intercept traps. Habitats include *Nothofagus* forests, broadleaf forest, coastal forests and secondary growth bush. Adult males recorded in January–March, May, June, September–December. Adult females in January–April and September–December.

#### Etymology

The species epithet is an arbitrary combination of letters and is to be treated as a noun.

#### Material examined

*Holotype*. New Zealand, North Island, Mataitai Forest S.A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall D21, 1♂ (AWMM, Cat. No. AMNZ66140).

*Paratype*. New Zealand, North Island, Mataitai Forest S.A., 39°59'S, 175°8'E (\*), i.2002, A. Warren leg., pitfall D15, 1♀ (AWMM, Cat. No. AMNZ61124).

*Additional material examined*. New Zealand, North Island, Kaweka Range, Ngahere catchment, Ngahererui Stm., 39°17'S, 176°24'52"E (\*), 20–27.xii.1983, J.C. Watt leg., pitfall, 965 m ASL, 1♀ (NZAC, Cat. No. Bag #92170); Waikawau Bay, 36°36'11"S, 175°31'41"E (\*), 22.xi.1993, A. Laroche & M.C. Larivière leg., 1♀ (NZAC, Cat. No. Bag #92170); North Island Lake Waikaremoana, 38°44'47"S, 177°8'19"E (\*), 7.xi.1995, G. Blackwell leg., pitfall trap, 1♀ (MNZ, Cat. No. AS.001523); Te Urewera National Park, Lake Waikaremoana, station 6, 38°44'47"S, 177°8'19" (\*), i.2005, pitfall traps 1 to 5, 1♀ (NZAC); Okiwi Bay, 41°6'40"S, 173°39'43"E (\*), ix.1984, T. Jones leg., Malaise trap, 1♂1♀ (NZAC); Tawharanui Regional Park, 36°22'53"S, 174°45'35"E (\*), 15–22.xii.1998, P. Paquin & N. Duperre leg., coastal forest, pitfall, 1♀ (NZAC, Bag #92170); AK Duck Creek S.R., 37°4'33"S, 175°47'01"E (\*), 3–10.ii.1999, P. Paquin & N. Duperre leg., broadleaf forest, pitfall, 1♀ (NZAC, Bag #92170); Okiwi Bay, 41°6'40"S, 173°39'43"E (\*), xii.1983, G. Simpson leg., second growth bush, Malaise Trap, 1♀2juv (NZAC); Okiwi Bay, 41°6'40"S, 173°39'43"E (\*), iii.1984, G. Simpson leg., second growth bush, Malaise Trap, 1♀ (NZAC); Katikati, Lund Road, 37°36'20"S, 175°53'24"E (\*), 15–29. xii.2010, P.A. Maddison leg., pitfall Trap L31–L40, 1♀ (NZAC); Waitakere, Spraggs Bush, 36°51'1"S, 174°32'33"E (\*), 3–17.xi.2008, P.A. Maddison leg., pitfall Trap Sp 3, 1♀ (NZAC); Waitakere, Scenic Drive N (Nr Anderson Tk), 36°53'18"S, 174°32'33"E (\*), 16–30.x.2009, P.A. Maddison leg., pitfall Traps 1–10, 1A, 2B, 1♂ (NZAC); Okiwi Bay, 41°6'40"S, 173°39'43"E (\*), 15–21.x.1983, G. Simpson leg., second growth

bush, Malaise Trap, 1♀ (NZAC); Little Barrier Island, 36°12'2.67"S, 175°5'11.44"E (\*), ix.1996, pitfall trap C7, 1♀ (MNZ); AK, Little Barrier Island, 36°12'2.67"S, 175°5'11.44"E (\*), i.1997, C.J. Green leg., pitfall C2, 1♀ (MNZ); AK, Little Barrier Island, 36°12'2.67"S, 175°5'11.44"E (\*), v.1997, C.J. Green leg., pitfall D1, 1♂ (MNZ); Little Barrier Island, 36°12'2.67"S, 175°5'11.44"E (\*), vi.1996, C.J. Green leg., pitfall trap E3, 1♂ (MNZ); Taranaki, Pouakai Ranges, 39°13'28.06"S, 174°2'10.33"E (\*), 9–13.i.1978, J.C. Watt leg., pitfall trap 12, 1160 m ASL, 1♀ (NZAC); Taranaki, Pouakai Ranges, 39°13'28.06"S, 174°2'10.33"E (\*), 9–13. i.1978, J.C. Watt & J.S. Dugdale leg., pitfall trap, 1220 m ASL, 1♂1♀ (NZAC); Taranaki, Pouakai Ranges, 39°13'28.06"S, 174°2'10.33"E (\*), 9–13.i.1978, J.C. Watt & J.S. Dugdale leg., pitfall trap, 1220 m ASL, 1♂ (NZAC); Taranaki, Whitecliffs, 38°49'37.93"S, 174°34'59.18"E (\*), 27. xii.1991, Les Stanley leg., 1♂ (MNZ) (vial includes parts from different species thus this is a doubtful record for Whitecliffs) Taranaki, Whitecliffs, 38°49'37.93"S, 174°34'59.18"E (\*), 27.xii.1991, Les Stanley leg., 1♀ (MNZ); Taranaki, Ahutakawa-Wakawa Swamp, 39°15'14.1"S, 174°2'37.41"E (\*), 29.xi.1975, A.K. Walker leg., pit-trap under *Dracophyllum longifolium*, 914 m ASL, 1♂ (NZAC); Te Pahi Bush, Te Pahi Coastal Park, 34°30'3.73"S, 172°48'35.11"E (\*), 7–9.ii.1975, J.C. Watt leg., pitfall, 1♂ (NZAC); Waikaremoana, 38°45'24.04"S, 177°9'10.09"E (\*), 22.iii.1996, G. Blackwell leg., pitfall trap T2P8, 1♂ (MNZ); Lake Waikaremoana, 38°45'24.04"S, 177°9'10.09"E (\*), 13.xii.1995, G. Blackwell leg., pitfall trap T2P9, 1♀ (MNZ); Duck Creek, 37°4'33"S, 175°47'01"E (\*), 22–29.xii.1998, P. Paquin & N. Duperre leg., forest, pitfall, 1♀ (NZAC, #219); Mt Te Aroha, BP, Tui Mine/Domain Tk, 37°31'18.96444"S, 175°43'52.15115"E (\*), 15.ii–7.iii.2010, D.S. Seldon & T. Buckley leg., pitfalls, 1♀ (MNZ, Cat. No. AS.002345); Kerr-Taylor Reserve, 36°44'52"S, 174°29'58"E (\*), 10–17.ii.1999, P. Paquin & N. Duperre leg., forest, pitfall, 1♂ (NZAC, #947); Kaimai-Mamaku Forest Park, Mt Te Aroha, upper end Tui Mine Track nr summit road, 37°31'39"S, 175°44'41"E (\*), 19.xi–26.xii.2005, A. Newton & M. Thayer leg., low *Nothofagus menziesii* forest with *Astelia* ground layer, flight intercept trap, 775 m ASL, 1♀ (FMNH); Trounson Kauri Park, ND, NZ, 35°43'32.68529"S, 173°38'29.32913"E (\*), 8–22.xii.2010, D.S. Seldon leg., pitfall traps, bait line, 3♂♂ (MNZ, Cat. No. AS.002344); Kerr-Taylor Reserve, 36°44'52"S, 174°29'58"E (\*), 17–24.ii.1999, P. Paquin & N. Duperre leg., forest, pitfall, 1♂ (NZAC, #1042); Mt Te Aroha, BP, NZ, Tui Mine/Domain Tk, 37°31'18.96444"S, 175°43'52.15115"E (\*), 15.ii–7.iii.2010, D.S. Seldon & T. Buckley leg., pitfall traps, 1♀ (MNZ, Cat. No. AS.002341); Kerr-Taylor Reserve, 36°44'52"S, 174°29'58"E (\*), 23–30.iii.1999, P. Paquin & N. Duperre leg., 1♀ (NZAC, #1526); Kerr-Taylor Reserve, 36°44'52"S, 174°29'58"E (\*), 15.ix–14.x.1999, G. Hall leg., pitfall, 1♀ (NZAC); Flexman S.R., 36°37'04"S, 174°40'42"E (\*), 30.iii–6. iv.1999, P. Paquin & N. Duperre leg., 1♀ (NZAC, #1597); Mataitai Forest S. A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall A5, 2♀♀ (AWMM, Cat. No. AMNZ66138); Mataitai Forest S.A., 39°59'S, 175°8'E (\*), ii.2002, A. Warren leg., pitfall A1, 1♂ (AWMM, Cat. No. AMNZ66139); Atuanui Mt Auckland, 36°27'S, 174°28'E (\*), i.2002, A. Warren leg., pitfall B11, 2♂♂ (AWMM, Cat. No. AMNZ67098); Kerr-Taylor Reserve, 36°44'52"S, 174°29'58"E (\*), 29.xii.1999–5.i.2000, P. Paquin & N. Duperre leg., 1♂ (NZAC, Bag #92170); Atuanui Mt Auckland, 36°27'S, 174°28'E (\*), i.2002, A. Warren leg., pitfall B11, 1♀ (AWMM, Cat. No. AMNZ67097); Atuanui Mt Auckland, 36°27'S, 174°28'E (\*), ii.2002, A. Warren leg., pitfall C13, 1♂ (AWMM, Cat. No. AMNZ66131); Atuanui Mt Auckland, 36°27'S, 174°28'E (\*), ii.2002, A. Warren leg., pitfall C23, 1♂ (AWMM, Cat. No. AMNZ66132); Great Barrier I, Te Paparahi, 36°10'S, 175°23'E (\*), iii.2002, A. Warren leg., pitfall F1, 1♂ (AWMM, Cat. No. AMNZ66126); Great Barrier I, Te Paparahi, 36°10'S, 175°23'E (\*), ii.2002, A. Warren leg., pitfall F23, 1♀ (AWMM, Cat. No. AMNZ66128); Great Barrier I, Te Paparahi, 36°10'S, 175°23'E (\*), ii.2002, A. Warren leg., pitfall E5, 1♂ (AWMM, Cat. No. AMNZ66129); ND Puketū SF, 35°14'0"S, 173°47'11"E (\*), 1981, R.H. Kleinpaste leg., forest, pitfall, 1♀ (NZAC).

***Whakamoke hunahuna*** Hormiga & Scharff, sp. nov.

(Fig. 44–45, 58)

<http://zoobank.org/NomenclaturalActs/893C06C3-A869-49E6-B77E-C07F3F4BF6FB>

*Diagnosis*

The male of *W. hunahuna* is most similar to those of *W. rakiura* and *W. heru*, but is distinguished by its shorter embolus and more robust apical region of the paracymbium (Fig. 45). The female is unknown.

*Description*

*Male holotype* (from South Island, Lee Stream Bridge, Outram). Total length 3.17. Cephalothorax 1.33 long, 1.01 wide. Sternum 0.91 long, 0.70 wide, shield-shaped. Abdomen 1.72 long, 1.20 wide. Colour as in Fig. 44A–C (preserved specimen). Fovea, longitudinal line (0.19), 0.14 times the length of cephalothorax. Chelicerae with slight proximal swellings anteriorly with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.11, all other eyes approximately same diameter. Clypeus height 0.30, 2.7 times AME diameter. All eyes close

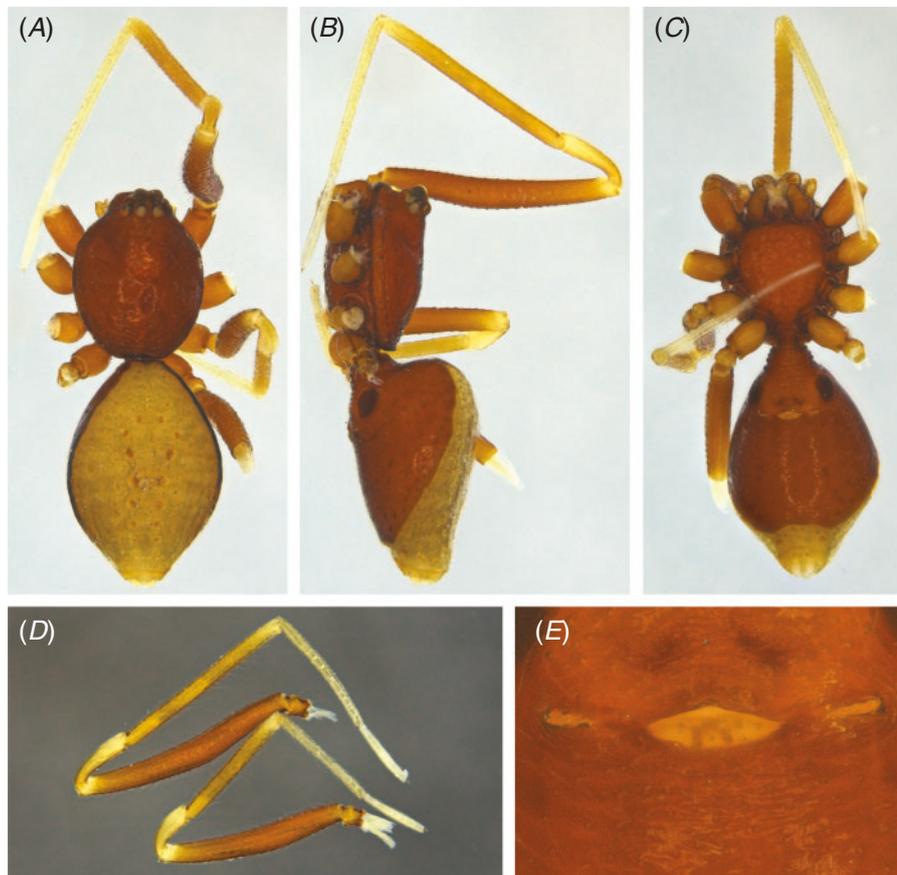
to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 44A, B). Ocular quadrangle same width anteriorly as posteriorly (Fig. 44A). Femur I 1.92 long, 1.4 times length of cephalothorax. Patella long, 0.65, 0.47 times length of cephalothorax. Tibiae and Metatarsi I and II without distinct macrospine pattern. Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.95. Tarsal organ = 0.89. Pedipalp (Fig. 45): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium apically moderately pointed in dorsal view (Fig. 45C). Tarsal organ in 0.76 position along longitudinal cymbial axis (Fig. 45B). Paracymbium long and robust, pointed apically. Embolus short, its apex not reaching the conductor basal apophysis, basally wider (Fig. 45A). Conductor a falciform process covering approximately half of the embolus length. CBA with an apical sclerotised process pointing ectally (Fig. 45B).

*Variation*

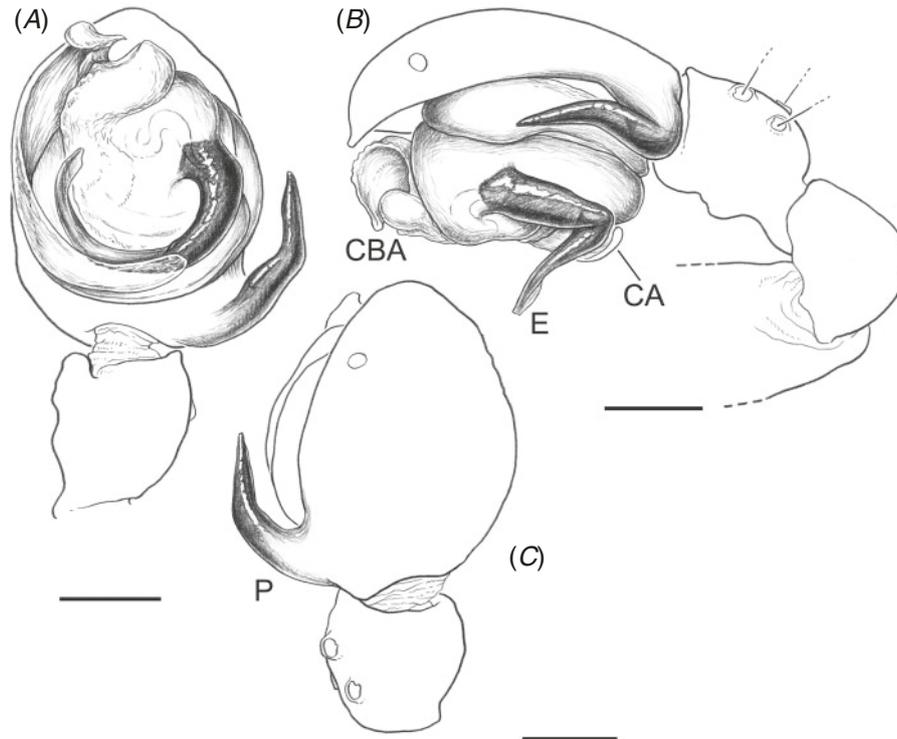
Known only from the type specimen.

*Distribution*

New Zealand, South Island. Known only from the type locality in the southern part of the South Island (Fig. 58).



**Fig. 44.** *Whakamoke hunahuna*, sp. nov., male from Outram. A, Dorsal. B, Ventral. C, Lateral. D, Legs I (top) and II (bottom). E, Epigastric fenestra.



**Fig. 45.** *Whakamoke hunahuna*, sp. nov., male palp, specimen from Outram. *A*, Ventral. *B*, Ectal. *C*, Dorsal. Scale bars, 0.1 mm. Abbreviations: C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

#### Natural history

No information available. The only specimen known, an adult male, was collected at the end of November. We tried, unsuccessfully, to find this species at the type locality in 2012. The holotype of *W. hunahuna* was collected in 1969 by C. L. Wilton, a sheep farmer and amateur New Zealand arachnologist (Forster 1967). At the present time (2012) there is a small patch of forest at the type locality, but the area is covered mainly with secondary growth along the stream creek and it is surrounded by agricultural fields.

#### Etymology

The species name is taken from the Māori word *hunahuna* (to hide, conceal, but also used as a modifier, meaning rarely seen, hidden) in reference to the scarcity of specimens of this species.

#### Material examined

*Holotype*. New Zealand, South Island, Lee Stream Bridge (West of Dunedin), Outram, Hindon Rd, S45°47'20.0": E 170°16'0.9" (\*), 30. xi.1969, C.L. Wilton leg., 1♂ (OM). Known only from the male holotype.

#### ***Whakamoke paoka*** Hormiga & Scharff, sp. nov.

(Fig. 2C, 9–14, 46–49, 59)

<http://zoobank.org/NomenclaturalActs/359DC78D-26E1-4D9B-83A8-C9AD9F6BA439>

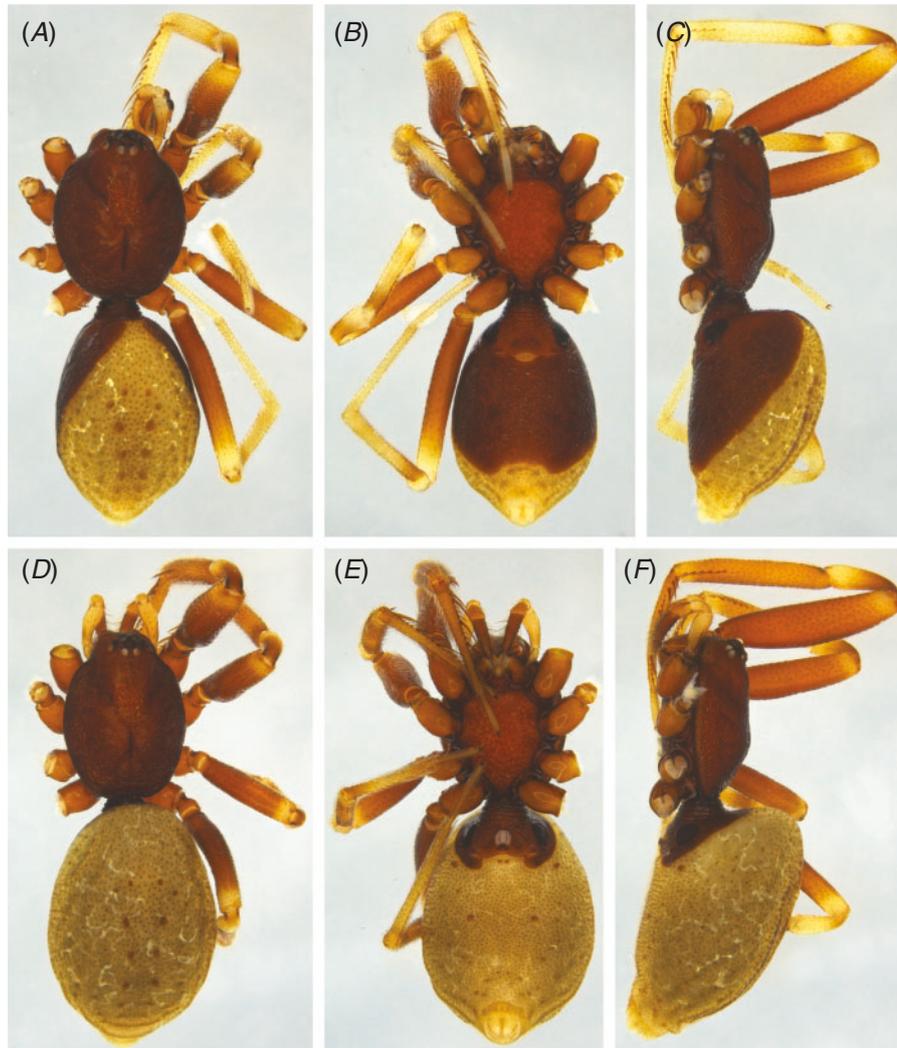
Malkarinae sp. b. Paquin *et al.* 2010: 40, fig. 17.5.

#### Diagnosis

Males of *W. paoka* can be distinguished from any other malkarids by their distinctively filiform paracymbial apex, unique to this species (Fig. 48A, B, D). Females of *W. paoka* (Fig. 49) are most similar in their epigynal morphology to those of *W. orongorongo* (Fig. 35), as both species share a semimembranous epigynal region divided into three longitudinal lobes by two deep incisions. These two species can be distinguished by the shape of the caudal triangular knob, which is about as wide as long in the former species but higher than wide in the latter (Fig. 49, 35).

#### Description

*Male holotype* (from Banks Peninsula, Kaituna Valley, 24. v.1975, OM). Total length 4.04. Cephalothorax 1.75 long, 1.37 wide. Sternum 1.16 long, 0.96 wide. Abdomen 2.17 long, 1.52 wide. Colour as in Fig. 46A–C (preserved specimen). Fovea a longitudinal line, 0.58 long, 0.24 times the length of the cephalothorax. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). Sternum oval, covered with irregularly shaped alveoli. Labium wider than long, fused to sternum. Endites longer than wide. AME diameter 0.09, larger than all other eyes. Clypeus height 0.36, 4 times AME diameter, concave. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed. Ocular quadrangle widest anteriorly (Fig. 46A).



**Fig. 46.** *Whakamoke paoka*, sp. nov., from Banks Peninsula. *A–C*, Male. *D–F*, Female. *A*, Dorsal. *B*, Ventral. *C*, Lateral. *D*, Dorsal. *E*, Ventral. *F*, Lateral.

Femur I 1.89 long, 1.08 times length of cephalothorax. Patella long, 0.83, 0.47 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (TbI 6L, Mtl prox-apic 1s1L1s1L3s1L3s1L3s1L4s; TbII 1s1L1s1L2s1L3s1L4s) (Fig. 14A–D, 47A). No other macrosetae on legs I–IV. Tarsi I and II barrel-shaped, thicker in the middle of the segment (Fig. 14E). Trichobothrium metatarsus I = 0.95. Tarsal organ = 0.86. Pedipalp (Banks Peninsula, Ellangowan Scenic Res. 18.ii.2011) (Fig. 10, 48): tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view only slightly longer than wide, lacking projections or apophyses (Fig. 48D). Tarsal organ conspicuous, in 0.6 position along longitudinal cymbial axis. Paracymbium highly sclerotised, with a broad base, tapering apically into a thin filiform process (Fig. 10H, 48A, D). Embolus thick, widest at mid length, in ventral view

circling approximately half the tegular margin with a tapering apical end that rests on the conductor basal apophysis (Fig. 10A, B, 48A). Conductor a falciform process covering approximately half of the embolus length (Fig. 10A, B, 48A). Spermduct diameter with a conspicuous constriction before entering into embolus, best seen in ventral view (Fig. 48A).

*Female paratype* (in same vial as holotype, OM). Total length 4.56. Cephalothorax 1.81 long, 1.44 wide. Sternum 1.22 long, 0.95 wide. Abdomen 2.70 long, 1.73 wide. Colour as in Fig. 46D–F (preserved specimen). Fovea, longitudinal line, almost one-fifth of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, with two prolateral and two retrolateral teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.09, larger than all other eyes. Clypeus height 0.35, 3.9 times one AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed. Ocular quadrangle widest anteriorly (Fig. 46D). Pedipalp with claw,



**Fig. 47.** *Whakamoke paoka*, sp. nov., from Banks Peninsula. *A, C*, Male. *B*, Female. *A, B*, Legs I (left) and II (right), dorsal. *C*, Male, epigastric fenestra.

tarsus with an ectoventral area along the full length of the segment lacking setae with many small transversal ridges. Femur I 2.05 long, 1.13 times length of cephalothorax, swollen in the middle (Fig. 47*B*). Patella long, 0.97, 0.54 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (TbI 6, Mtl 1s1L1s1L3s1L3s1L3s1L4s; TbII 5, MtlII 1s1L1s1L2s1L3s1L4s) (Fig. 47*B*). Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.93. Tarsal organ = 0.87. Epigynum (Banks Peninsula, Ellangowan Scenic Res., 18.ii.2011) (Fig. 12*F*, 49): epigynal region longer than wide, fully encircled by a highly sclerotised ventral scutum with a sclerotised caudal triangular knob. Central epigynal area distinctly less sclerotised and semimembranous, divided into three longitudinal lobes by two deep incisions, the medial lobe being approximately two and one-half times the width of the lateral lobes and continuous with the caudal knob. Copulatory ducts run longitudinally from copulatory openings, turn medially to then loop dorsally, and descend into more or less globular spermathecae with a spiculate internal surface (more so caudally) (Fig. 49*B*). Fertilisation ducts caudally directed.

#### Variation

**Males:** total length 3.77–4.18 ( $n = 5$ ). Cephalothorax length 1.62–1.79 ( $n = 5$ ), cephalothorax width 1.28–1.42 ( $n = 5$ ). **Females:** total length 4.16–5.30 ( $n = 7$ ). Cephalothorax length 1.75–1.99 ( $n = 8$ ), cephalothorax width 1.38–1.52 ( $n = 8$ ).

#### Distribution

All records of *W. paoka* come from the Canterbury Region of the South Island, and most records are from the Banks Peninsula (Fig. 59). Specimens have also been taken from

localities further inland, at Lake Janet and Coopers Creek, both within ~50 km from the Banks Peninsula.

#### Natural history

Specimens have been found under logs and sifted from litter and moss in *Nothofagus* forests as well as mixed forest. A single specimen has been sifted from flax litter (*Linum usitatissimum*) from Dean Bush in Christchurch. Adult males have been recorded in February, March, May, July, and October. Adult females have been recorded all year round, except in January and September.

#### Etymology

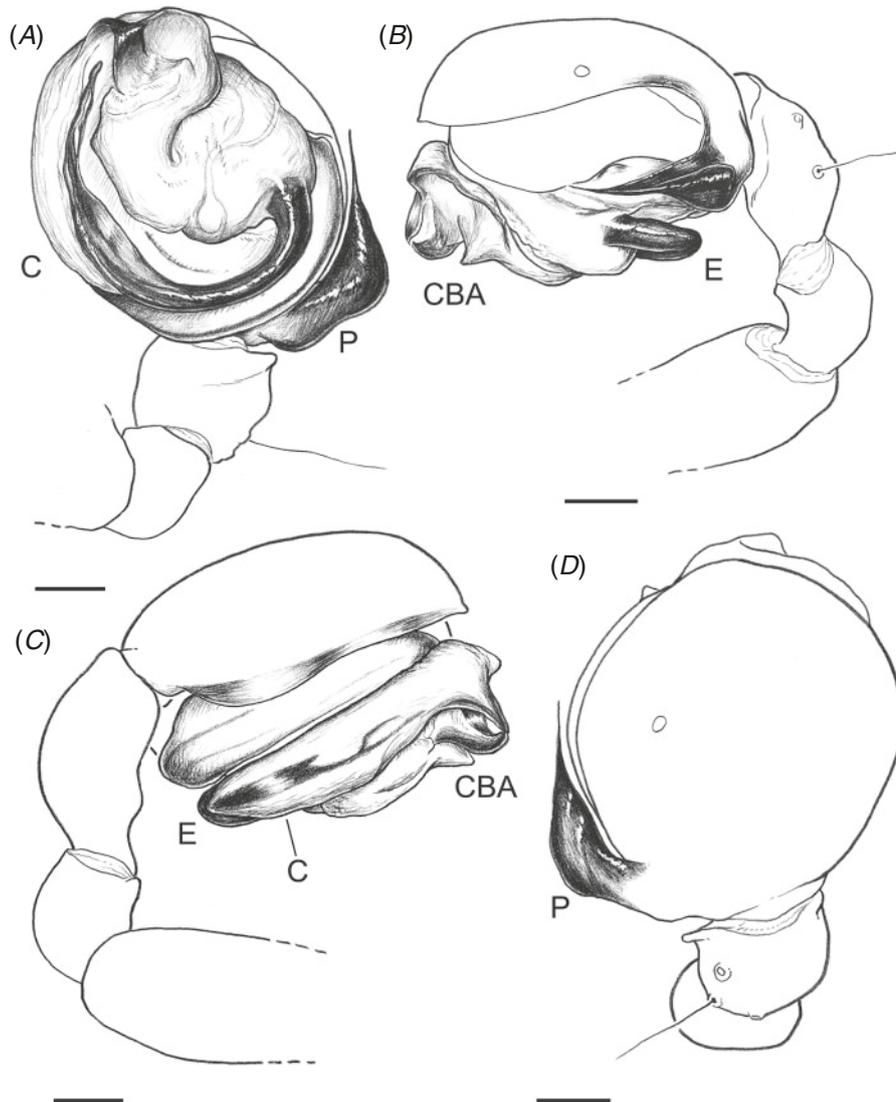
The species name is taken from the Māori word for pointed stick, skewer, in reference to the sharp distal end of the paracymbium of this species.

#### Material examined

**Holotype.** 1♂, New Zealand, South Island, Canterbury, Banks Peninsula, Kaituna Valley, 43°45'42.25"S, 172°41'20.49"E (\*), 24.v.1975, R.R. Forster leg., under logs in bush, 1M (OM).

**Paratype.** Same data, together with male holotype. 1♀ (OM).

**Additional material examined.** New Zealand, South Island, Banks Peninsula, Hinewai Reserve, 43°48'38.0"S, 173°1'15.6"E, 3.iii.2010, N. Scharff & G. Hormiga leg., sifted leaf litter and moss, 508 m ASL, 6♂♂, 3♀♀, 2 juveniles (ZMUC); same data, 1♂, 2♀♀ (GWU); Lake Janet, 43°8'11.79"S 172°33'15.11"E (\*), 31.vii.1949, R.R. Forster leg., under logs, 1♀, (very pale specimen) (OM); MC, Banks Peninsula, Ellangowan Scenic Reserve, 43°47'52.34"S, 173°2'11.45"E, 18.ii.2011, A. Schomann & J. Pedersen leg., mixed deciduous forest, sifted litter (mainly *Nothofagus*), 600 m ASL, 2♂♂, 4♀♀ (ZMUC); Canterbury, Banks Peninsula, Kaituna Valley, 43°45'42.25"S, 172°41'20.49"E (\*), 24.v.1975, R.R. Forster leg., under logs in bush, 2♂♂, 3♀♀ (OM) (one female without abdomen); Canterbury, Deans Bush, Christchurch, 43°31'39.12"S, 172°35'49.41"E (\*), 20.xii.1949, J.S. Dugdale leg., R.R. Forster det., 1995, 1♀, (OM); Canterbury, Coopers Creek, 43°16'58.45"S, 172°6'58"E (\*), 18.x.1953, R.R. Forster leg., under log, 1♀ (OM); Canterbury, Banks Peninsula,



**Fig. 48.** *Whakamoke paoka*, sp. nov., male palp, specimen from Banks Peninsula. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: C, conductor; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium.

Akaroa, S43°48'14.19", E172°58'18.69" (\*), xi.1959, R.R. Forster leg., 2♀♀, (OM); Canterbury, Banks Peninsula, Kaituna Valley, 43°45'42.25"S, 172°41'20.49"E (\*), 17.x.1967, C.L. Wilton leg., R.R. Forster det., 1995, 2♀♀, (OM) (One female is missing abdomen); Canterbury, Okuku Pass, 43°7'3.19"S, 172°26'50.66"E (\*), 21.v.1956, R.R. Forster leg., 1♀, (OM); Canterbury, Banks Peninsula, Kaituna Valley, 43°45'42.25"S, 172°41'20.49"E (\*), 13.iv.1967, C.L. Wilton leg., R.R. Forster det., under log, 1♀, (OM); Canterbury, Banks Peninsula, Kaituna Valley, 43°45'42.25"S, 172°41'20.49"E (\*), 1.xi.1966, R.R. Forster leg., 1♀, (OM); Canterbury Deans Bush, Christchurch, 43°31'39.12"S, 172°35'49.41"E (\*), 24.vii.1974, A.D. Blest leg., R.R. Forster det., 1995, flax litter, 1♂, (OM); Canterbury, Banks Peninsula, Akaroa, 43°48'14.19"S, 172°58'18.69"E (\*), 14.x.1949, R.R. Forster leg., 1♂, 2♀♀, (OM); Christchurch Co., Banks Peninsula, Hinewai Reserve, 43°48'38.0"S, 173°1'15.6"E (\*), 27.viii.1996, C.J. Vink leg., beech forest, 1♀, (ZMUC); Banks Peninsula, Hays Reserve, 43°42'10"S, 172°53'52"E, 13.iii.2003, C.J. Vink leg., forest, 1♂ (Lincoln University); Hinewai Reserve,

43°50'S, 173°4'E, 17.x.2000, C.J. Vink leg., beech forest, 1♀ (Lincoln University); MC, Banks Peninsula, Hinewai Reserve, 43°48'38.0"S, 173°1'15.6"E (\*), 7.ii.1995, C.J. Vink leg., litter beside track near river, 1♀ (Lincoln University); Montgomery Park Reserve, 43°44'42"S, 172°52'12"E, 5.xi.2010, J. Malumbres-Olarte & C.J. Vink leg., forest, 1♀ (MNZ); Peraki Saddle Reserve, 43°49'12"S, 172°51'36"E, 5.xi.2010, J. Malumbres-Olarte & C.J. Vink leg., forest, 1♀ (MNZ); Banks Peninsula, Hinewai Reserve, 43°48'38.0"S, 173°1'15.6"E (\*), 22.vi.2007, mixed forest, under log, 1♀ (NZCM).

***Whakamoke heru* Hormiga & Scharff, sp. nov.**

(Fig. 1*B*, *C*, 15–17, 50–53, 59)

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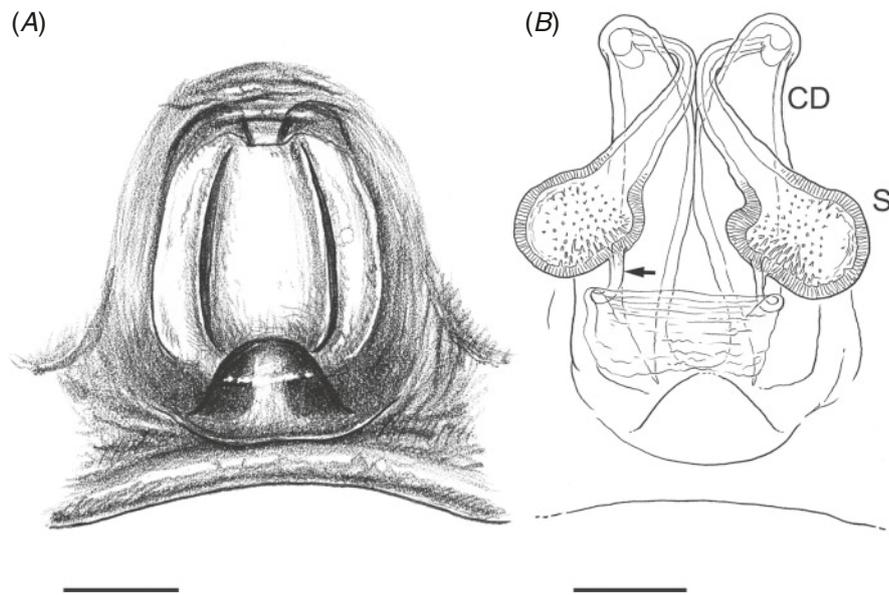


Fig. 49. *Whakamoke paoka*, sp. nov., epigynum, specimen from Banks Peninsula. A, Ventral (the caudal knob is the dark triangular structure at the bottom of the illustration). B, Dorsal, cleared (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.

#### Diagnosis

The male palp of *W. heru* (Fig. 52) is most similar to that of *W. guacamole* (Fig. 42) but it can be most easily distinguished by the shape of the proximal end of the embolus as it connects to the embolus base, which is distinctly enlarged in the latter species (Fig. 42A, B). Females of *W. heru* (Fig. 53) are most similar in their epigynal morphology to those of *W. guacamole* (Fig. 43A) but can be distinguished by the absence of a medial septum in the latter (there is a septum shaped as an inverted heart in *W. heru*).

#### Description

**Male holotype** (from South Island, Iwituroa Reserve, Catalogue Number AS.001506). Total length 3.26. Cephalothorax 1.30 long, 1.11 wide. Sternum 0.99 long, 0.78 wide, shield-shaped. Abdomen 1.99 long, 1.18 wide. Colour as in Fig. 50A–C (preserved specimen). Fovea, longitudinal line (0.21), almost one-sixth of cephalothorax length. Chelicerae with slight proximal swellings anteriorly (Fig. 15A, C), two proximal promarginal and two retromarginal teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.09, all other eyes approximately same diameter. Clypeus height 0.33, 3.7 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 50A, C). Ocular quadrangle same width anteriorly as posteriorly (Fig. 50A). Femur I 2.06 long, 1.58 times length of cephalothorax. Patella long, 0.75, 0.58 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 51A)

(spination less pronounced in males of this species – not obvious when looking at habitus; Tbi 6L, Mti prox-apic 1s1L2s1L3s1L3s1L3s1L4s ; Tbi 5L, Mti 1s1L1s1L2s 1L3s1L4s). Tarsi I and II slightly thicker in the middle of the segment. Trichobothrium metatarsus I = 0.94. Tarsal organ I = 0.88. Pedipalp (Kahurangi National Park, Flora Saddle 7. iii.2010) (Fig. 16, 17, 52): pedipalpal femur engrossed, robust. Tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view longer than wide (Fig. 52D), lacking projections or apophyses, tapering towards the apex. Tarsal organ in 0.79 position along longitudinal cymbial axis (Fig. 52B). Paracymbium with a broad base, sinuous, tapering apically to a thin point, with posterior concave margin in ectal view (Fig. 17F, 52A, D). Embolus widest at the base, in ventral view circling approximately half the tegular margin with a spatulated apical end that rests away from the conductor basal apophyses (Fig. 16A–C, 17A–C, E, 52A). Conductor falciform process covering approximately three-quarters of the embolus length (Fig. 52C). Spermduct diameter lacking constriction before entering into embolus.

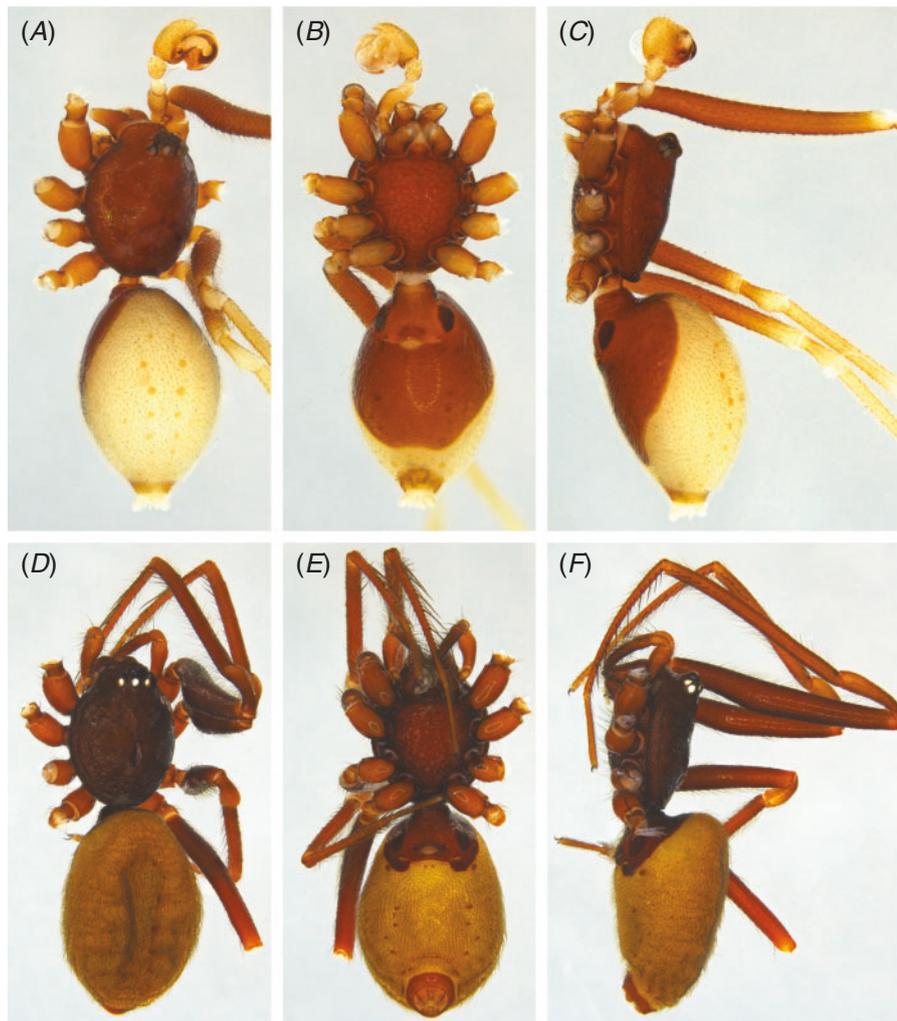
**Female paratype** (from North Island, Karori Wildlife Sanctuary; Catalogue Number AS.002375). Total length 4.59. Cephalothorax 1.57 long, 1.25 wide. Sternum 1.07 long, 0.88 wide. Abdomen 2.92 long, 2.04 wide. Colour as in Fig. 50D–F (preserved specimen). Fovea, longitudinal line (0.21 long), almost one-eighth of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, two proximal promarginal and two retromarginal teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.10, all eyes of equal size. Clypeus height 0.36, 3.6 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral

eyes juxtaposed (Fig. 50F). Ocular quadrangle equally wide anteriorly and posteriorly (Fig. 50D). Pedipalp with claw, tarsus with an ectoventral area along the full length of the segment lacking setae with many small transversal ridges. Pedipalpal femur incrassate, robust. Femur I 2.95 long, 1.88 times length of cephalothorax, swollen in the middle (Fig. 50F). Patella long, 0.89, 0.57 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (Fig. 51B) The following spine formula is taken directly from the female leg photo: Tbl 6L, Mtl prox-apic 1s1L3s1L3s1L3s1L3s1L4s; TblII 5L, MtlII 1s1L1s1L3s1L3s1L4s. Tarsi I and II not particularly barrel-shaped, long and with almost same thickness throughout length of segment. Tarsal organ = 0.86. Trichobothrium metatarsus I = 0.96. Epigynum (Kahurangi National Park, Flora Saddle, 7.iii.2010) (Fig. 53):

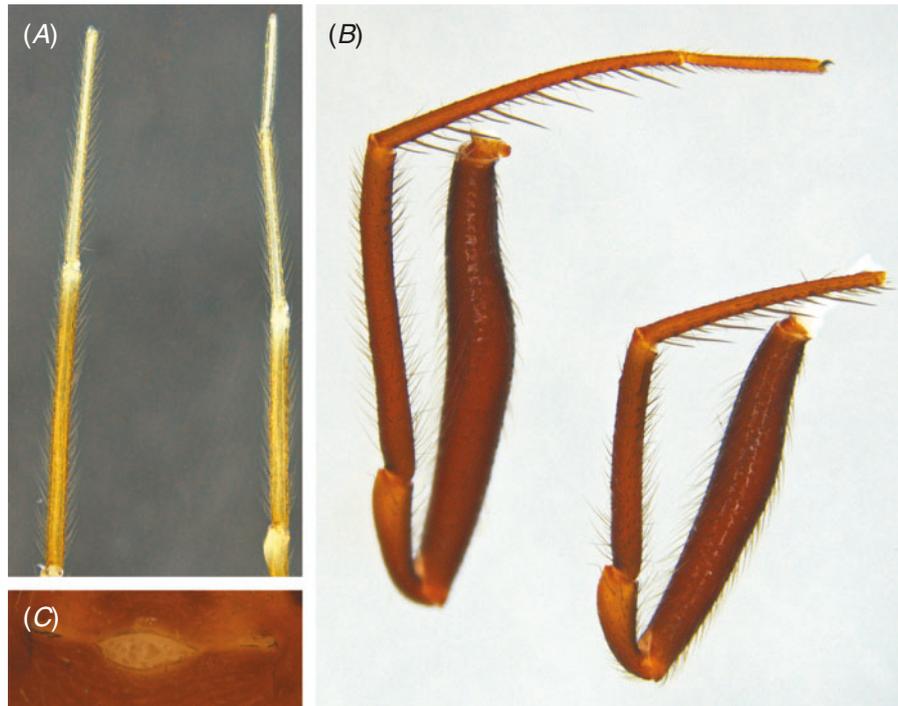
epigynal region wider than long, fully encircled by a highly sclerotised ventral scutum with a sclerotised lip along the caudal margin, medially indented (Fig. 53A). Lateral and anterior margins of epigynal cavity less sclerotised, semimembranous. A lightly sclerotised medial septum shaped as an inverted heart and continuous with the caudal lip fills most of the epigynal cavity (Fig. 53A). Internal genitalia (Arthur's Pass, Devils Punchbowl, M. Pruvic, May 1998): short copulatory ducts, ventral to the spermathecae, wider proximally, leading to globular spermathecae with a spiculate internal surface (Fig. 53B). Fertilisation ducts emerging caudally from spermathecae, curving externally.

#### Variation

*Males*: total length 3.02–3.47 ( $n = 4$ ). Cephalothorax length 1.30–1.67 ( $n = 5$ ), cephalothorax width 1.06–1.29 ( $n = 5$ ).



**Fig. 50.** *Whakamoke heru*, sp. nov. A–C, Male from Iwituaroa Reserve, Queen Charlotte Sound. D–F, Female from Piano Flat. A, Dorsal. B, Ventral. C, Lateral. D, Dorsal. E, Ventral. F, Lateral.



**Fig. 51.** *Whakamoke heru*, sp. nov. *A, C*, Male from Iwituaroa Reserve, Queen Charlotte Sound. *B*, Female from Piano Flat. *A, B*, Legs I (left) and II (right), dorsal. *C*, Male, epigastric fenestra.

*Females*: total length 3.81–5.03 ( $n = 7$ ). Cephalothorax length 1.57–1.88 ( $n = 8$ ), cephalothorax width 1.25–1.41 ( $n = 7$ ).

#### Distribution

New Zealand, southern part of the North Island and widespread on the South Island (Fig. 59).

#### Natural history

Specimens of *W. heru* have been found under logs and sifted from leaf litter in *Nothofagus*, hardwood and saltwater forests. Specimens have also been taken in pitfall traps in the same kind of forests. A single specimen was caught in a flight intercept trap. Adult males recorded in January–March, May, August and December; adult females in January–May and October–December.

#### Etymology

The species name is taken from the Māori word *heru* (comb) in reference to the conspicuous spination pattern of the first two pairs of legs.

#### Material examined

*Holotype*. New Zealand, South Island, Iwituaroa Reserve, Queen Charlotte Sound, 41°16'25"S, 173°56'07"E (\*), i.1987, E.C. Murphy leg., pitfall 2, 1♂, 2juv. (MNZ; Cat. No. AS.001506).

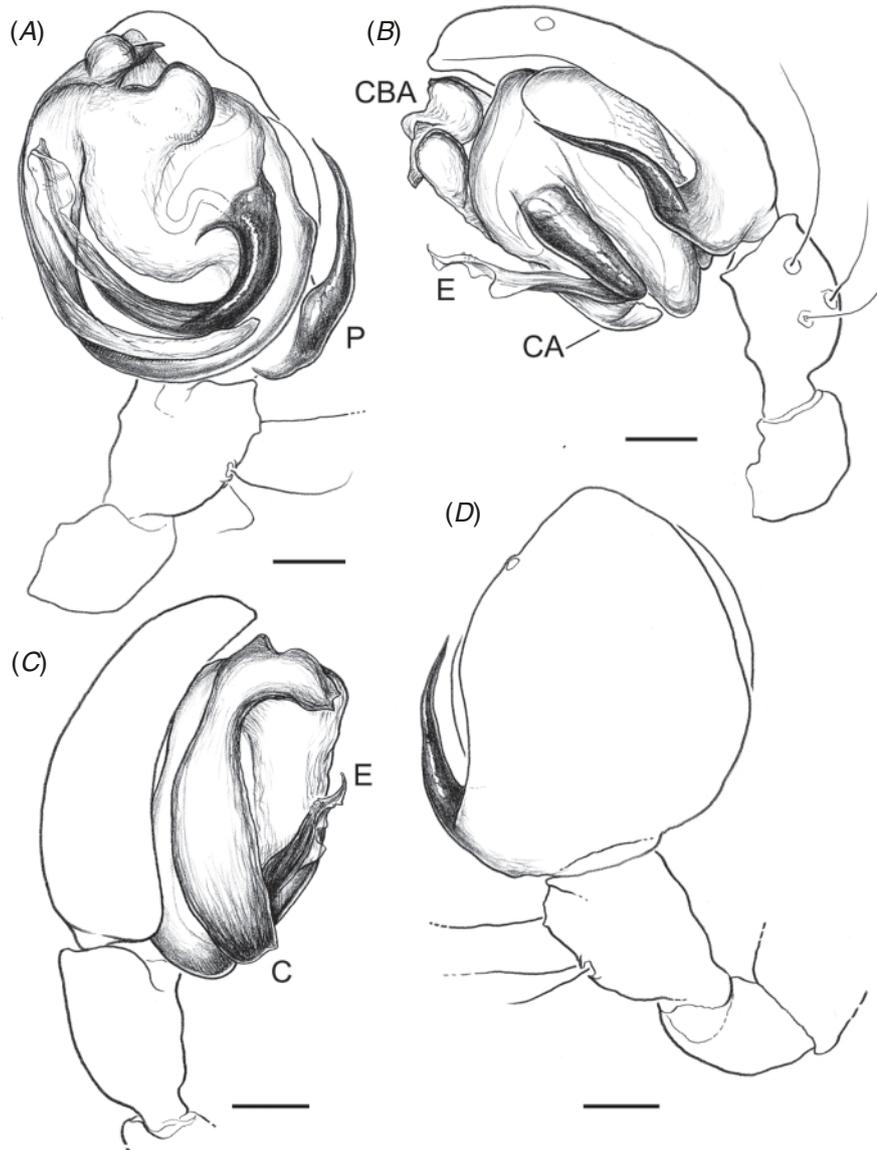
*Paratype*. New Zealand, South Island, Karori Wildlife Sanctuary, 41°17'26.94"S, 174°45'12.16"E (\*), ii.1997, L. Berndt leg., native forest, pitfall traps A-T, 1♀ (MNZ; Cat. No. AS.002375).

*Additional material examined*. New Zealand, North Island, Wellington, Orongorongo Valley, Silver Beech Forest, 41°23'41.3"S, 174°55'28.01"E (\*), x.1975, R.R. Forster leg., pitfall Ecol. Divn., 1♀ (QM); North Island, Akatarawa Saddle, 41°4'44"S, 175°6'29"E (\*), 11–25.viii.1998, P.H. Berben leg., hardwood forest, pitfall, 400–540 m ASL, 1♂ (MNZ; Cat. No. AS.001521); North Island, Wellington, Kapiti Is., 40°51'6.75"S, 174°54'49.23"E (\*), v.1947, R.R. Forster leg., 1♂ (OM); North Island, Orongorongo Valley, N, 41°24'17"S, 174°55'01"E (\*), 1. x.1995, P. Berben & J. Alley leg., silver beech, pitfall trap 8, 1♀ (MNZ); South Island, Flora Saddle, 41°11'24.3"S, 172°44'28.8"E, 7.iii.2010, N. Scharff & G. Hormiga leg., litter and logs, 970 m ASL, 1♀ (ZMUC; same data, 1♀ (ZMUC; Cat. No. ZMUC00012747); South Island, Westland, Bullock Creek, 43°29'39.95"S, 169°56'38.09"E (\*), 18.i.1951, R.R. Forster leg., leaf litter, 1♂, 1♀ (OM); South Island, Westland, Bullock Creek, 43°29'39.95"S, 169°56'38.09"E (\*), 18.i.1951, R.R. Forster leg., leaf litter, 1♂ (OM); South Island, Nelson Mount Arthur Track, Mount Arthur Tableland, 41°12'54.95"S, 172°40'1.48"E (\*), 22.i.1948, R.R. Forster leg., under log in beech forest, 1♂, 1♀ (OM). South Island, Otago, Dunedin, Leith Saddle, 45°50'9.71"S, 170°29'53.79"E (\*), 13.xi.1978, R.R. Forster, leaf litter, 1♀ (OM). South Island, Otago, Dunedin, Leith Saddle, 45°50'9.71"S, 170°29'53.79"E (\*), 26.iii.1977, R.R. Forster, 1♂♀ (OM). South Island, Otago, Dunedin, Leith Saddle, 45°50'9.71"S, 170°29'53.79"E (\*), 24.ii.1979, 1♀ (OM). South Island, Otago, Dunedin, Leith Saddle, 45°50'9.71"S, 170°29'53.79"E (\*), 12.viii.1967, R.R. Forster, pitfall trap, 1♀ (OM).

#### *Whakamoke rakiura* Hormiga & Scharff, sp. nov.

(Fig. 1A, 54–56, 59)

<http://zoobank.org/NomenclaturalActs/71727364-089A-453A-A4D3-B13A-BB454488>



**Fig. 52.** *Whakamoke heru*, sp. nov., male palp, specimen from Flora Saddle, Kahurangi National Park. *A*, Ventral. *B*, Ectal. *C*, Mesal. *D*, Dorsal. Scale bars: 0.1 mm. Abbreviations: BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; E, embolus; EB, embolus base; P, paracymbium; ST, subtegulum; T, tegulum.

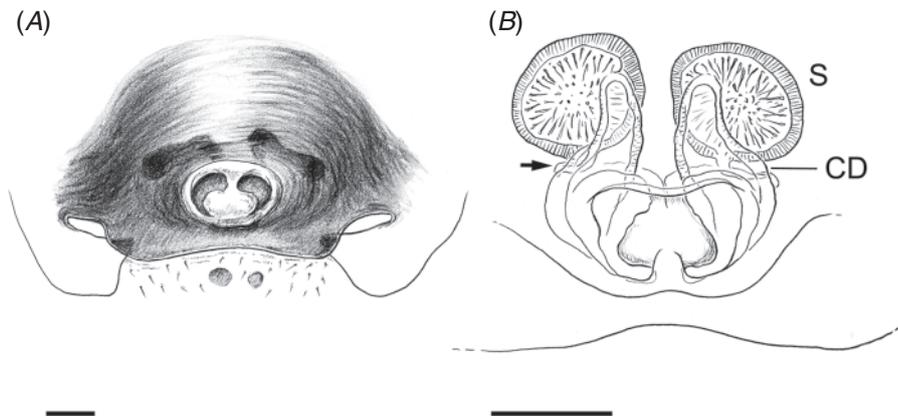
### Diagnosis

Males of *W. rakiura* are most similar to those of *W. heru* but can be most easily distinguished by the wider embolus diameter (particularly at mid length) of the former species (Fig. 56*A*). Females of *W. rakiura* are most similar in their epigynal morphology to those of *W. heru* but can be distinguished from the latter by a subtle indentation of the anterior epigynal margin (Fig. 56*C*), which is not indented in

*W. heru* (Fig. 53*A*), and by the presence of a well-defined lip in the caudal epigynal margin.

### Description

*Male holotype* (from Stewart Island, Garden Mound). Total length 4.13. Cephalothorax 1.83 long, 1.54 wide. Sternum 1.19 long, 1.03 wide, shield-shaped. Abdomen 2.44 long, 1.55 wide. Colour as in Fig. 54*A–C* (preserved specimen, rather



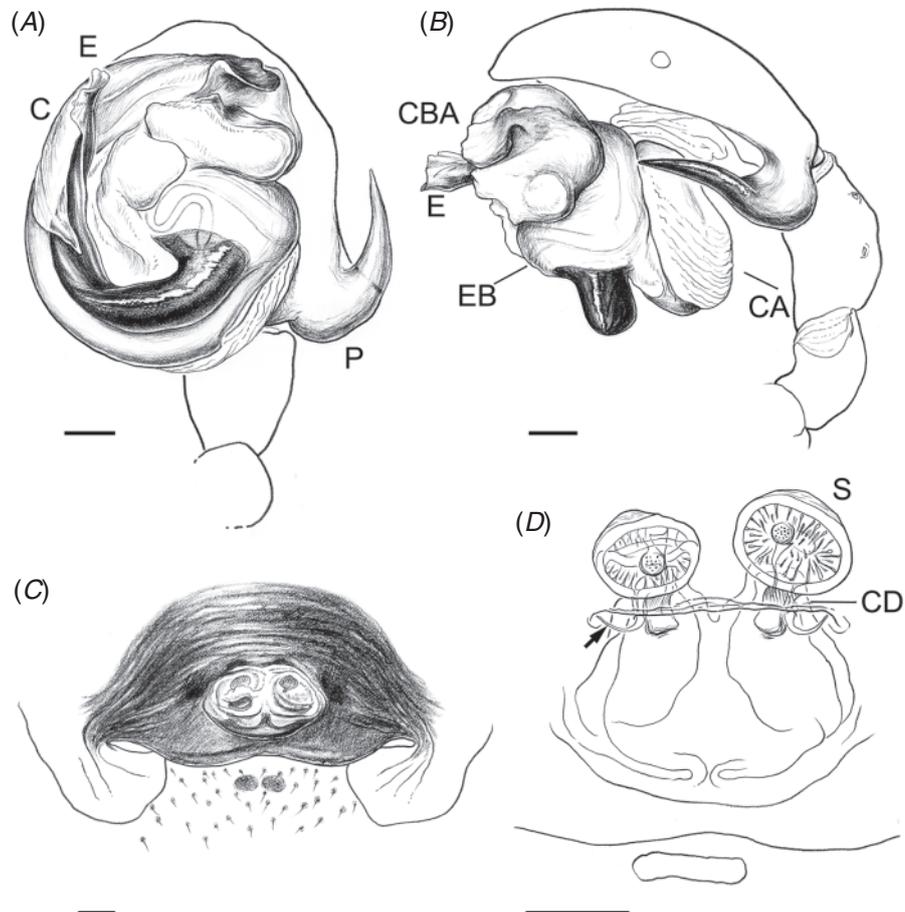
**Fig. 53.** *Whakamoke heru*, sp. nov., epigynum. *A*, Ventral, specimen from Flora Saddle, Kahurangi National Park. *B*, Dorsal, cleared, specimen from Devil's Punchbowl, Arthur's Pass (arrow, fertilisation duct). Scale bars: 0.1 mm. Abbreviations: CD, copulatory duct; S, spermatheca.



**Fig. 54.** *Whakamoke rakiura*, sp. nov. *A–C*, Male from Garden Mound, Stewart Island. *D–F*, Female specimen from Fern Gully, Stewart Island. *A*, Dorsal. *B*, Ventral. *C*, Lateral. *D*, Dorsal. *E*, Ventral. *F*, Lateral.



**Fig. 55.** *Whakamoke rakiura*, sp. nov. *A, C*, Male from Garden Mound, Stewart Island. *B*, Female specimen from Fern Gulley, Stewart Island. *A, B*, Legs I (left) and II (right), dorsal. *C*, Male, epigastric fenestra.



**Fig. 56.** *Whakamoke rakiura*, sp. nov. *A*, Male palp, ventral, specimen from Garden Mound, Stewart Island. *B*, Male palp, ectal. *C*, Epigynum, ventral, specimen from Fern Gulley, Stewart Island. *D*, Epigynum, cleared, dorsal, specimen from Garden Mound, Stewart Island. Scale bars: 0.1 mm. Abbreviations: BH, basal haematodocha; C, conductor; CA, conductor apex; CBA, conductor basal apophysis; CD, copulatory duct; E, embolus; EB, embolus base; P, paracymbium; S, spermatheca; ST, subtegulum; T, tegulum.

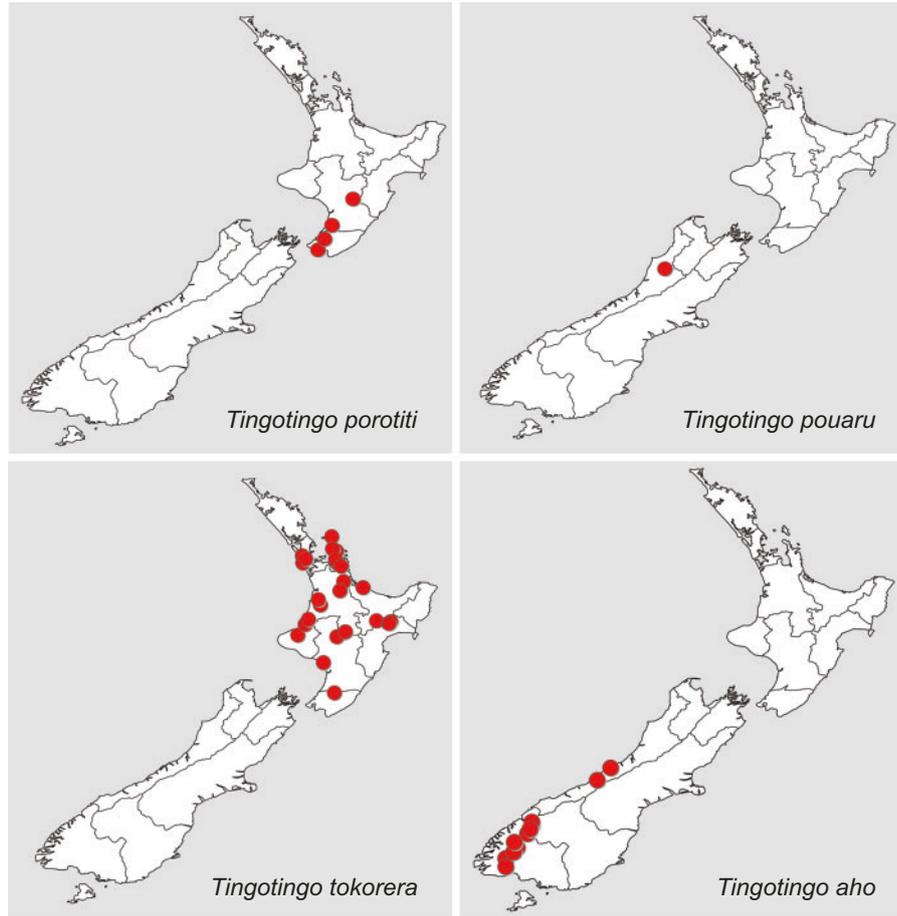


Fig. 57. Distribution of specimen records of *Tingotingo* species.

pale, probably damaged by light or bleached). Fovea, longitudinal line (0.27), almost one-seventh of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, with two proximal promarginal and two retromarginal teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.10, all other eyes same diameter. Clypeus height (0.41) 4.1 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 54A). Ocular quadrangle same width anteriorly as posteriorly (Fig. 54A). Femur I 2.31 long, 1.26 times length of cephalothorax. Patella long, 0.96, 0.53 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short prolateral macrosetae along the entire length of the leg segments (TbI 5L, MtI prox-apic 1s1L1s1L2s1L3s1L3s1L4s; TbII 5L, MtII 1s2L2s1L3s1L4s). Tarsi I and II barrel-shaped, thicker in the middle of the segment. Trichobothrium metatarsus I = 0.96. Tarsal organ = 0.82. Pedipalp (Fig. 56A, B): femur engrossed, robust. Tibia unmodified, with one dorsal and two retrolateral trichobothria. Cymbium in dorsal view only slightly longer than wide, lacking

projections or apophyses. Tarsal organ conspicuous, in 0.57 position along longitudinal cymbial axis (Fig. 56B). Paracymbium highly sclerotised, with a broad base, tapering apically. Embolus thick, widest at the base and with a subtle twist at mid length, in ventral view circling slightly less than half the tegular margin with a multilobular and twisted apical end that rests away from the conductor basal apophysis (Fig. 56A). Conductor falciform process covering approximately half of the embolus length. Spermduct diameter lacking constriction before entering into embolus (Fig. 56A).

*Female paratype* (from Stewart Island, Fern Gulley). Total length 4.77. Cephalothorax 1.94 long, 1.61 wide. Sternum 1.28 long, 1.14 wide. Abdomen 2.87 long, 1.75 wide. Colour as in Fig. 54D–F (preserved specimen). Fovea, longitudinal line, almost one-seventh of cephalothorax length. Chelicerae with slight proximal swellings anteriorly, with two proximal promarginal and two retromarginal teeth (a subtle mound adjacent to most proximal prolateral tooth, between prolateral and retrolateral rows). AME diameter 0.09, all eyes of equal size. Clypeus height (0.41) 4.5 times AME diameter. All eyes close to each other, less than their diameter apart. Lateral eyes juxtaposed (Fig. 54D, F). Ocular quadrangle equally wide anteriorly and

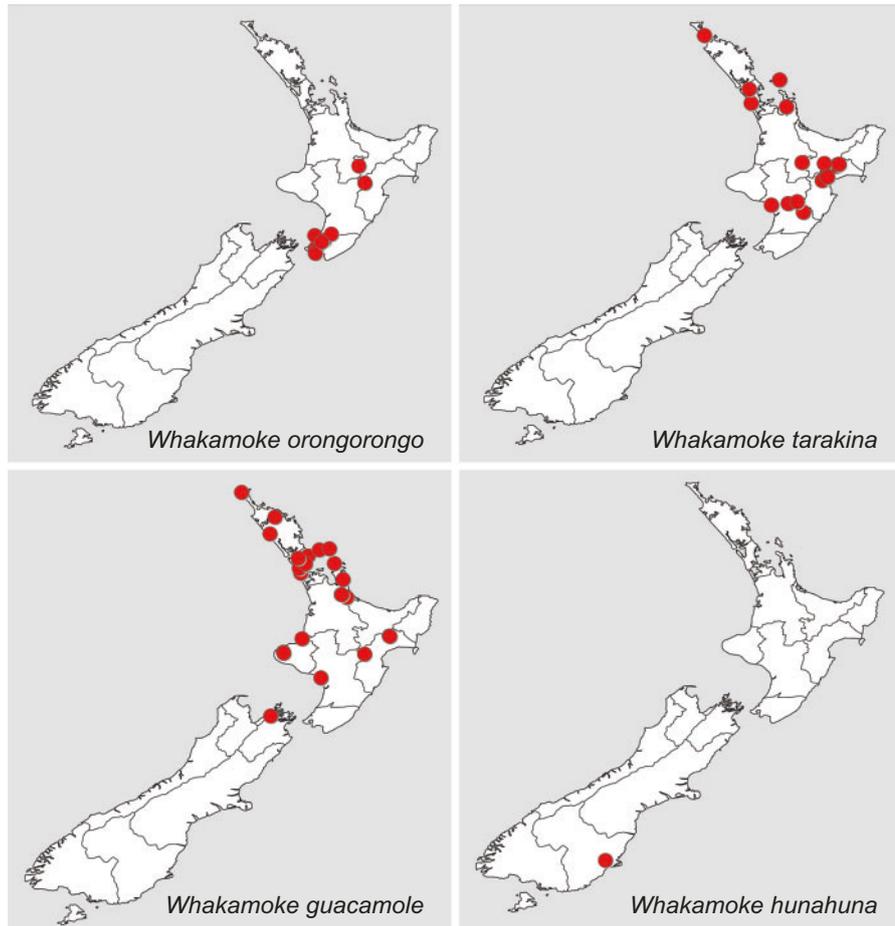


Fig. 58. Distribution of specimen records of *Whakamoke* species (1).

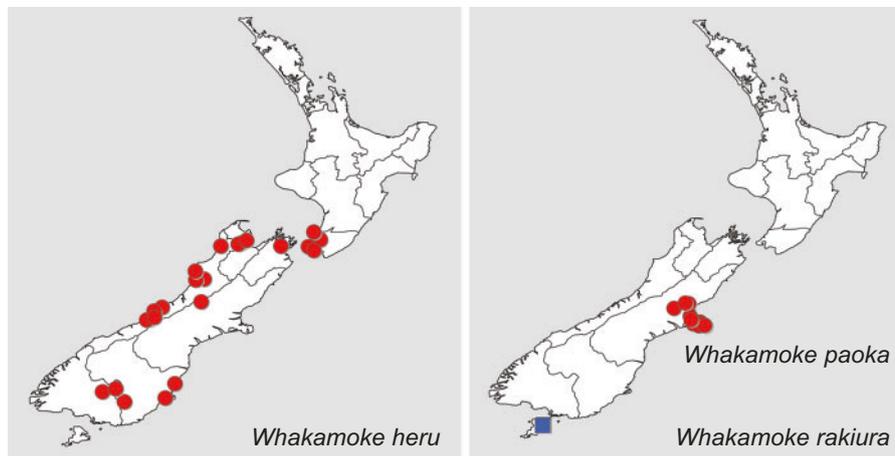


Fig. 59. Distribution of specimen records of *Whakamoke* species (2).

posteriorly (Fig. 54D). Pedipalp with claw, tarsus with an ectoventral area along the full length of the segment lacking setae with many small transversal ridges. Pedipalpal femur engrossed, robust. Femur I 2.70 long, 1.39 times length of

cephalothorax, swollen in the middle (Fig. 54F). Patella long, 1.06, 0.55 times length of cephalothorax. Tibiae I and II with long prolateral macrosetae on distal third of leg segments. Metatarsi I and II with series of interspersed long and short

prolateral macrosetae along the entire length of the leg segments (TbI 5L, MtI 1s1L1s1L3s1L3s1L4s; TbII 5L, MtII 1s2L2s1L3s 1L4s). Tarsi I and II not barrel-shaped, same thickness throughout length of segment. Trichobothrium metatarsus I = 0.94. Tarsal organ = 0.87. Epigynum (specimen from Raroa Reserve 4–13.iii.1996) (Fig. 56C, D): epigynal region wider than long, cordiform, anteriorly cleaved and fully encircled by a highly sclerotised ventral scutum with a sclerotised lip along the caudal margin. Lateral and anterior margins of epigynal cavity less sclerotised, semimembranous. A medial process, continuous with a medial septum extends the full width of the epigynal cavity, anterior to the caudal lip (Fig. 56D). Short copulatory ducts leading to globular spermathecae with a spiculate internal surface. Fertilisation ducts emerging caudally from spermathecae, curving externally (Fig. 56D).

#### Variation

*Males*: only the holotype specimen was available for study.

*Females*: total length 4.85–5.17 ( $n = 4$ ). Cephalothorax length 1.96–2.10 ( $n = 4$ ), cephalothorax width 1.59–1.65 ( $n = 4$ ).

#### Distribution

New Zealand, Stewart Island. All available specimens have been collected within a few kilometres of Orban (northern part of the island) (Fig. 59).

#### Natural history

The few specimens known have been sifted from tree-fern leaf litter and taken in pitfall traps under crown ferns (*Blechnum discolor*) in rimu (*Dacrydium cupressinum*) and kamahi (*Weinmannia racemosa*) vegetation. Adult male recorded in November, adult females in January, March and November.

#### Etymology

The species epithet is taken from the Māori name of Stewart Island.

#### Material examined

*Holotype*. New Zealand, South Island, Stewart Island, Garden Mound, 46°51'56"S, 168°07'25"E (\*), 24.xi.1946, R.R. Forster leg., 1♂ (palp partly expanded) (OM).

*Paratype*. New Zealand, Stewart Island, Fern Gulley, 46°53'41"S, 168°06'42"E (\*), 09.iii.1986, R.R. Forster leg., from tree fern leaf litter, 1♀ (OM).

*Additional material examined*. New Zealand, N.E. Stewart Island, Kaipipi Track, Paterson, 46°53'53.03"S, 168°05'29.34"E, (\*), 11.i.1960, R.C. Ordish leg., 1♀ (MNZ); Stewart Island, Garden Mound, 46°51'56"S, 168°07'25"E, (\*), 24.xi.1946, R.R. Forster leg., 1♀ (OM); Stewart Island, Raroa Reserve, Halfmoon Bay, MNZ 260 E48 379564, 46°53'42"S, 168°07'34"E (\*), 4–13.iii.1996, Mike Avis DOC S.I. leg., 50 pitfall traps under Rimu/Kamahi, Crown fern, 1♀, 1juvenile (MNZ).

#### Conflicts of interest

The authors declare that they have no conflicts of interest.

#### Declaration of funding

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#### Acknowledgements

We dedicate this paper to the late Ray F. Forster (1922–2000), New Zealand's most eminent arachnologist, in recognition for his towering contribution to the study of the arachnids of New Zealand and other parts of the Southern Hemisphere. At the time of his death, Forster had an unfinished manuscript revising the non-pararchaeine malkarids of New Zealand. He had also assembled a relatively modest number of vials, mainly the specimens he had collected himself. We thank Robert J. Raven (QM) for his efforts to secure and for sharing the Forster material with us. Although we had a copy of Forster's in-progress manuscript, our revision was done without consulting his work. We have carried out the study of New Zealand fauna while simultaneously studying the malkarids of Australia. We thank the following individuals for making malkarid specimens from New Zealand and Australia available to us: Robert J. Raven, Michael G. Rix and Owen Seeman (QM), Mark S. Harvey and Julianne Waldock (WAM), Graham Milledge (AM), Peter Lillywhite (NMVM), Norman Platnick and Louis Sorkin (AMNH), Christine Rolland (MNH), Grace Hall and Robert J. B. Hoare (NZAC), Phil Sirvid, and Brian M. Fitzgerald (MNZ), John W. Early and Dhahara Ranatunga (AWMM), Cor Vink (CMNZ and Lincoln University Entomology Collection), and Catherine Byrne and Kirrily Moore (Tasmanian Museum and Art Gallery, Hobart). For our field work in New Zealand and Australia, we received support from many colleagues, including Fernando Alvarez-Padilla, Miquel Arnedo, Barbara Baehr, Caitlin Baker, Catherine Byrne, Rosa Fernández, Gonzalo Giribet, Mark S. Harvey, Robert Kallal, Lara Lopardo, Jagoba Malumbres-Olarte, Graham Millidge, Andrew Mitchell, Kirrily Moore, Jan Pedersen, Robert J. Raven, Michael G. Rix, Jamie Seymour, and Cor Vink. Special thanks to Martín J. Ramírez for allowing us to use his beautiful SEM images of the spinnerets of *Chilenodes australis*. Thanks also to Charles Griswold for sharing his unpublished SEM images of the spinnerets of *Ozarchaea platnicki*. Bryce McQuillan and Greg Anderson graciously allowed us to use their photographs of *Whakamoke* and *Malkara* respectively. As far as we know, Bryce McQuillan is the only person who has ever observed a malkarid feeding on another spider (Fig. 2A). We are grateful to Thomas Pape for his nomenclatural advice. We thank New Zealand's Department of Conservation Te Papa Atawhai for issuing the research and collection permits that have made this work possible. Michael G. Rix, Associate Editor Mark S. Harvey and an anonymous reviewer provided helpful comments on an earlier version of this paper.

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